NUCLEAR SCIENCE ABSTRACTS

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GENERAL

9186 AECU-3496

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PROGRESS REPORT NO. 43 [FOR] PERIOD SEPTEMBER 1, 1956 THROUGH NOVEMBER 30, 1956. 70p. Contracts AT(30-1)-905 and Nonr-1841(16). $10.80(ph OTS); $3.90 (mf OTS).

In Chemistry of the Fission Elements the mechanism of formation of tetrachlorodicuprate complexes was rechecked and the electrodeposition behavior of Cu, Ni, and Mn was studied. The Nuclear Chemistry (Inorganic) Group reports the investigation of the ion exchange behavior of Zn, determination of the dissociation constant of $HClO_4$ in HCl–bis 2-chloroethyl ether, and the solvent extraction of In, Tl, and Au in HCl–bis 2-chloroethyl ether, and the solvent extraction of In, Tl, and Au in HCl–bis 2-chloroethyl ether. Also reported is a study of the deuteron and fast neutron fission of U^{238} and Th^{232}. In Nuclear Chemistry (Organic) the isotopic chemical effect of hydrogen isotopes in nitration of toluene-α-t, methanolysis and solvolysis of triphenylmethyl chloride, decarboxylation of β-keto acids, and ion pair formation in decomposition of alkyl chlorosulfites was studied. Results and apparatus are given for an experiment to measure nuclear cross section at an energy around 50 Bev, using cosmic rays at 10,600 ft, as a source of high-energy protons and neutrons. Data are included on composite lateral distribution, size distribution, arrival directions, and μ-meson component of large air showers. Results from new angular-distribution run on $Al^{27}(d,p)Al^{28}$ at 6 Mev are tabulated. Proton inelastic scattering data from Ni^{58}, Ni^{60}, Ag, Mn^{55}, and Co^{59} are given. Experimental work on the Co^{57} decay scheme is completed and results are described. Ground state angular distribution data for $C^{12}(\alpha,p)N^{15}$ reactions are graphed. A study has been performed which indicates that the Wilkinson and Goldhaber-Teller theories of the giant resonance in photonuclear reactions are nearly identical. Previous results for the solution for the T-matrix for pion production in pion-nucleon collisions have been improved by including all scattering states in the "one meson approximation." (For preceding period see AECU-3423.) (M.H.R.)

RESEARCH PROGRAMS

9187 AERE-Inf/Bib-110

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

LIST OF UNCLASSIFIED AERE REPORTS, JANUARY 1952 TO DECEMBER 1955. L. J. Anthony and P. M. Harris. Jan. 1957. 25p. $0.72(OTS).

A bibliography of unclassified reports issued up to Dec. 1955, but not made available for sale, is presented. (W.L.H.)

9188 BNL-430

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1–DECEMBER 31, 1956. 64p. $0.40(OTS).

Abstracts of work submitted for journal publication or presentation at scientific meetings are included in the fields of physics, chemistry, nuclear engineering, biology, and medicine. Some information is given on meson studies. Comparison is made of pulse shapes in two photomultiplier tubes. A graph of the variability of fall-out composition during rainfall of July 21, 1956 is included. Data on the energy response and track length in NTA track films are given. Brief summaries are included on other research in progress but no data presented. (M.H.R.)

9189 ORNL-2302

Oak Ridge National Lab., Tenn.

PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MARCH 10, 1957. June 24, 1957. 60p. Contract W-7405-eng-26. $0.40(OTS).

Investigations indicate the feasibility of producing high current for reasonable cost with a rapidly pulsed alternating-gradient proton synchrotron with high-energy injection from a 900-Mev AVF cyclotron. The value 0.20 ± 0.03 is given for the internal-conversion coefficient of the 163-kev gamma ray in the 5p shell of Xe^{131}. The s- and d-wave phase shifts for neutron scattering from oxygen, together with the single-particle bound s and d states of O^{17}, are found to fit reasonably well with a single static potential having a diffuse boundary and a Thomas spin-orbit energy term. Coulomb excitation of 2^+ states in the even-even isotopes of tin and zirconium has been observed by bombarding targets of enriched tin isotopes and normal zirconium with 8-, 9-, and 10-Mev doubly ionized alpha particles accelerated by the 5.5 Mv electrostatic generator. Preliminary data are given for the $P^{31}(p,p'\gamma)P^{31}$ and $P^{31}(p,\alpha,\gamma)Si^{28}$ reactions. Absolute (p,n) cross sections are reported for Cl^{37}, Cr^{53}, Co^{59}, Cu^{65}, Se^{77}, Se^{82}, and Nb^{93} for proton energies from threshold to 0.5 Mev above threshold. Two new levels of C^{13} have been found at excitations 5.49 ± 0.08 and 6.09 ± 0.08 Mev by studying the proton spectrum in the $B^{11}(He^3,p)C^{13}$ reaction. Results are given for the total neutron cross section of isotopes K^{39}, K^{41}, and Rb^{87} in the kilovolt energy region and for the neutron time-of-flight spectrum from $Be^9(d,n)B^{10}$ and $B^{11}(d,n)C^{12}$ reactions. A helium-filled cloud chamber was used as a fast-neutron polarization analyzer and checked with $H^3(p,n)He^3$ neutrons. Isomeric states were excited in $Pb(T_{1/2} = 127 \pm 10\ \mu sec)$ and in $As^{75}(T_{1/2} = 18 \pm 2$ msec) by the (n,n') reaction. The neutron activation cross sections near 26 kev have been measured for about 50 nuclei with Sb–Be neutrons. From investigation of the kinetic behavior of small H_2O–U^{235} subcritical systems, the nonescape probability for a fission neutron source is obtained as a function of the size of the system. Cross sections for dissociation of H_2^+ were determined in various stopping gases in the energy range 500 kev to 2.25 Mev. In the decay of C^{14} in CO_2, results indicate that the molecule remains bound as the NO_2^+ ion in 81.4% of the decays. Neutron diffraction patterns obtained on solid solutions of $FeCl_2$ and $CoCl_2$ at low temperatures indicate that the axis of magnetization in these antiferromagnetic compounds changes regularly with the sample composition. Discussions on magnetic ordering in He_2O_3 and Mn_2O_3 and low-intensity background measurements are included. (For preceding period see ORNL-2204.) (M.H.R.)

BIOLOGY AND MEDICINE

9190
A PROCEDURE FOR THYROIDECTOMY IN SHEEP. L. A. George, Jr., C. M. Barnes, and L. K. Bustad (General Electric Co., Richland, Wash.) J. Am. Vet. Med. Assoc. 130, No. 9, 403-5(1957) May.

9191
EFFECT OF ETHYLENEDIAMINETETRAACETIC ACID ON DEPOSITION AND EXCRETION OF CERTAIN RARE EARTH ELEMENTS. Harry Foreman and Camille Finnegan (Los Alamos Scientific Lab., N. Mex.). J. Biol. Chem. 226, 745-9(1957) June.

RADIATION EFFECTS

9192 UWFL-43
Washington. Univ., Seattle. Applied Fisheries Lab.
RADIOBIOLOGICAL RESURVEY OF RONGELAP AND AILINGINAE ATOLLS, MARSHALL ISLANDS, OCTOBER–NOVEMBER 1955. Dec. 30, 1955. 91p. Contract AT(45-1)-540. $0.50(OTS).

The radiobiological survey showed a great variability in the materials contributing to the radioactivity of various samples. In coconuts and marine animals, no traces of Sr^{90} have been found; in other land plants the Sr^{90} constituted 2 to 5% of total activity, and in the skeletal salts of land crabs up to 50%. Only small amounts of radioactive cesium were found in marine animals, but in some of the land plants it contributed up to 100% of the total activity; however, the marine animals contained more Ce^{144} than the land plants. (R.V.J.)

9193
ROLE OF HEMOGLOBIN AFFINITY AND CONCENTRATION IN DETERMINING HYPOXIA TOLERANCE OF MAMMALS DURING INFANCY, HYPOXIA, HYPEROXIA AND IRRADIATION. J. N. Barker (Duke Univ. School of Medicine, Durham, N. C.). Am. J. Physiol. 189, 281-9 (1957) May.

9194
THE INFLUENCE OF THE RELEASED DEOXYRIBONUCLEASE UPON THE DEOXYRIBONUCLEIC ACID OF SPLEEN CELLS OF IRRADIATED RATS. Desanka D. Mančić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 119-21(1957) Mar.

The activity of acid-active desoxyribonuclease in spleen of rats, irradiated with sublethal and lethal doses, was measured to determine whether there is a connection between the fall of desoxyribonucleic acid content and increased activity of enzyme after x irradiation. (auth)

9195
THE INFLUENCE OF X-RAYS ON THE BLOOD CONSTITUENTS OF NEW-BORN RATS. Srdjan I. Hajduković. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 123-7 (1957) Mar. (In French)

The effects of x rays on blood constituents of new-born rats were studied. The animals were chosen so as to make it possible to compare hematological reactions with and without all the suprarenal reactions. The results favor a direct action of x rays. A strong reticulocytal crisis was indicated. (tr-auth)

9196
MODIFICATION OF THE DEOXYRIBONUCLEASE ACTIVITY IN THE SERUM AND URINE OF IRRADIATED DOGS. Milan M. Jovanović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 129-32(1957) Mar. (In French)

Irradiation frees the desoxyribonuclease of intracellular structures. This liberation permits the desoxyribonuclease to attack DNA. It is possible to determine the increase in enzymatic activity by measuring the quantity of DNA hydrolyzed. (tr-auth)

9197
REACTION OF THE SUPRARENAL GLAND TO X-IRRADIATION. Milan M. Jovanović, Srdjan I. Hajduković, Miodrag Denić, and Ljubica G. Grban. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 133-8(1957) Mar. (In French)

The suprarenals of a rat irradiated with 850 r of x rays responded with a drop in the amount of ascorbic acid and cholesterol. The reaction of the suprarenal gland subjected to sublethal x radiation was studied. (tr-auth)

9198
EFFECT OF HYPOTHERMIA ON RADIOSENSITIVITY OF RATS. Srdjan I. Hajduković and Jovan I. Karanović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 139-47 (1957) Mar.

Recent results of investigations into the effect of x rays on the chilled hibernating animals have shown that the combined action of cysteine and chilling can give full protection (100%) even after the exposure to lethal doses. (auth)

9199
THE ACTION OF X RADIATION ON THE GROWTH OF INTERNODAL CELLS OF THE ALGAE CHARA VULGARIS. J. Moutschen. Experientia 13, No. 6, 240(1957). (In French)

9200
EXPERIMENTAL INVESTIGATIONS ON THE INFLUENCE OF X-RAYS ON GLYCOGEN CONTENT IN SURVIVING LEUCOCYTES. G. Astaldi and L. Verga. Experimenta 13, No. 6, 244-5(1957).

RADIATION HAZARDS AND PROTECTION

9201 AERE-HP/R-2056(Amended)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
RADIOSTRONTIUM FALLOUT IN BIOLOGICAL MATERIALS IN BRITAIN. F. J. Bryant, A. C. Chamberlain, A. Morgan, and G. S. Spicer. Sept. 5, 1956. Reissued with amendments May 1957. 49p. $1.26.

Methods are described for the determination of Sr^{90} due to fall-out from nuclear explosions in soils, vegetation, bones, and milk. Results of measurements on British samples up to the spring of 1956 are given. The current levels in Britain are shown to be very similar to those reported for the United States. (auth)

9202 HW-49840
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIOACTIVITY LEVELS OF THE COLUMBIA RIVER BELOW RICHLAND, WASHINGTON FOR THE PERIOD OCTOBER, NOVEMBER, DECEMBER 1956. H. V. Clukey. Apr. 23, 1957. 8p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS)

Downstream from Richland, Washington, there is a gradual decrease in concentration of radioactive isotopes. The concentration of α particle emitters in water averages less than 5×10^{-9} μc/cc at all locations. The activity of α particle emitters in mud samples was below the detection limit of 3×10^{-6} μc/gm. Because of low river flow in water upstream of McNary, the β particle emitters increased by a factor of about 2 with averages ranging from (6 to 62) $\times$ 10^{-7} μc/cc. In river mud at the low water stages, averages $\sim$ (2 to 6) $\times$ 10^{-5} μc/gm. Downstream from McNary Dam, concentrations of β particle emitters in water averaged (0.8 to 5) $\times$ 10^{-7} μc/cc, also, about twice the average from

previous quarters. River flow was the lowest of any period in the last several years. (For preceding period see HW-47170.) (R.V.J.)

9203 NYO-4714

New York Operations Office. Health and Safety Lab., AEC. RADIATION PROTECTION WITHIN A STANDARD HOUSING STRUCTURE. Robert T. Graveson. Nov. 1956. 13p. $0.15(OTS).

A one story building was the subject of a radiation survey, subsequent to fall-out contamination of the surrounding area. The thin aluminum walls of the building offered no significant shielding. However, the gamma radiation reading at the center of the building on the uncontaminated surface, under the roof cover effectively reduced the γ-dose rate at the center of the building by a factor of 10 compared to the open field readings. The distribution of dose rate measured from 1 to 7 feet above the floor surface, indicated areas within the building, close to the floor, where the dose rate was considerably reduced. (auth)

9204

VAGINAL APPLICATION OF CYSTAMINE AND LOCAL RADIO-PROTECTION. L. Darcis and G. Gilson. Experientia 13, No. 6, 242-3(1957). (In French)

9205

THE EFFECTS OF NUCLEAR WEAPONS. Samuel Glasstone, ed. Washington, U. S. Atomic Energy Commission, 1957. 587p. $2.00.

The most recent data concerning the effects associated with explosions of nuclear weapons are presented. The data have been obtained from observations made of effects of nuclear bombing in Japan and tests carried out at the Eniwetok Proving Grounds and Nevada Test Site, as well as from experiments with conventional explosives, and mathematical calculations. The volume is intended for use in planning against possible nuclear attack. (R.V.J.)

9206

RESEARCH IN THE EFFECTS AND INFLUENCES OF THE NUCLEAR BOMB TEST EXPLOSIONS. VOLUME I AND II. Ueno, Tokyo, Japan Society for the Promotion of Sciences, 1956. 1837p.

A compilation is given of the scientific research made in meteorology, physics, chemistry, fisheries science, economics, and medical science to show the effects and influences of nuclear bomb test explosions at the Bikini Atoll Test and, also, the after-effects of the atomic bomb on the injured in Hiroshima and Nagasaki. (R.V.J.)

TRACER APPLICATIONS

9207

MEASUREMENT OF REGIONAL SODIUM TURNOVER RATES AND THEIR APPLICATION TO THE ESTIMATION OF REGIONAL BLOOD FLOW. Ernest L. Dobson and George F. Warner (Univ. of California, Berkeley). Am. J. Physiol. 189, 269-76(1957) May.

9208

VARIABILITY OF SPECIFIC ACTIVITIES AND SPECIFIC-ACTIVITY RATIOS. Robert L. Stearman and Thomas G. Ward (John Hopkins Univ., Baltimore, Md.). Arch. Biochem. Biophys. 68, 249-54(1957) June.

9209

ABSORPTION AND DISTRIBUTION OF BARIUM ADMINISTERED INTRAVENOUSLY AND ORALLY IN THE RAT. Robert Castagnou, Claude Paoletti, and Suzanne Larcebeau. Compt. rend. 244, 2994-6(1957) June 12. (In French)

After intravenous and oral administration of radioactive Ba into some rats, its localization with time in different organs and tissues was studied. The primordial affinity of the Ba for bone and muscle, its importance for the lungs, minor importance for the liver, spleen, and kidneys, and unimportance to the brain, heart and hair are shown. The method of travel in the blood was studied as well. (tr-auth)

CHEMISTRY

9210 IGR-R/CA-216

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England. LOW TEMPERATURE DISTILLATION OF MIXTURES OF CORROSIVE HALOGEN COMPOUNDS. P. L. Allen and J. F. Ellis. Apr. 1957. 7p.

One method which might be employed for analysis of a mixture of corrosive halogen compounds is fractional distillation at low temperatures. The possibilities of this method have been investigated. The results show that a mixture of HCl and Cl_2 can be completely separated by fractional distillation at low temperature. Hydrogen fluoride forms azeotropes with Cl_2 with ClF_3 and with BrF_5. Chlorine trifluoride and HCl react at low temperatures to give Cl and HF. For complex mixtures, this method may form a useful auxiliary analytical means of producing simpler fractions which could be examined by other methods. (auth)

9211 NP-6332

Shell Development Co., Emeryville, Calif. RESEARCH IN HIGH TEMPERATURE BEARING LUBRICATION IN THE ABSENCE OF LIQUID LUBRICANTS. Progress Report No. 7 for February 1957 through April 1957. C. H. Bailey and S. S. Sorem. 19p. Contract AF33(616)-2999. (S-13722).

With respect to the increased temperatures explored during this report period, the following conclusions may be tentatively drawn. Some materials which are effective film forming agents at lower temperatures become ineffective or even detrimental at higher temperatures. A phosphorous additive, triisopropyl phosphite, remains effective at 800°F and in one test permitted operation at 950°F. At 2/3 "catalog rated load" bearing wear and deterioration under "protective atmosphere" appear nearly independent of temperature between 700 and 900°F. Bearing fatigue appears to be a problem with moderately loaded bearings at high operating temperatures. (auth)

9212 NP-6333

Massachusetts Inst. of Tech., Cambridge. THE EVAPORATION OF WATER AT HIGH HUMIDITIES. Part III of Final Report. Thomas K. Sherwood and Oliverio Phillips. Apr. 15, 1957. 233p. OOR Project No. TB2-0001 (887). Contract DA-19-020-ORD-3244.

The factors by which changes in concentration of the diffusing compound affect the rates of mass transfer between a gas and a wet surface are discussed. The study included evaporation from a wetted-wall tower, and the evaporation of water from a porous wet cylinder. In all runs turbulent conditions were maintained in the gas phase. A theoretical discussion is included of diffusion in the evaporation process. (W.L.H.)

9213 NYO-7715

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics. DIAZO DERIVATIVES OF β-DIKETONES. W. Conard Fernelius, Lillian D. Berg, and Guilia Irving. July 10, 1956. 11p. Contract AT(30-1)-907. $3.30(ph OTS); $2.40(mf OTS).

Diazonium salts have been coupled with a number of β-

diketones to form compounds which are yellow to red in color, are easily purified by recrystallization, and have sharp melting points. The β-diketones used had the following types of terminal groups: aliphatic, aromatic, heterocyclic, perfluoroaliphatic, methoxymethyl and carboxyethyl. Coupling also takes place with nitrogen-heterocyclic ketones where the nitrogen atom is in the same position as the second oxygen in a β-diketone: $-N=C-CH_2C=O-$. (auth)

9214 ORNL-2291

Oak Ridge National Lab., Tenn.

CHEMICAL AND ISOTOPIC STUDIES OF THE NITROX SYSTEM FOR N^{15} ENRICHMENT. G. M. Begun, L. L. Brown, L. B. Yeatts, N. C. Bradley, and E. F. Joseph. June 25, 1957. 20p. Contract W-7405-eng-26. $0.25 (OTS).

The Nitrox system for concentration of N_2 isotopes has been studied in detail; in this system use is made of the exchange reaction between HNO_3 and the oxides of nitrogen. The isotopic separation factor for the system has been found to vary from 1.064 at 1 M HNO_3 to 1.020 at 15.5 M HNO_3. The conversion of HNO_3 to oxides of nitrogen with gaseous SO_2 in the product refluxer has been studied, and suitable refluxers have been designed. A small, two-column enriching cascade has been designed and operated which produced gram quantities of highly enriched N^{15}. (auth)

9215

EFFECT OF COMPETITIVE INHIBITORS ON THE INACTIVATION OF D-AMINO ACID OXIDASE AND ITS PROTEIN COMPONENT BY OXYGEN. J. Raymond Klein (Brookhaven National Lab., Upton, N. Y.). Arch. Biochem. Biophys. 67, 423-31(1957) Apr.

9216

KINETICS OF THE REACTIONS OF RADIOBROMINE ACTIVATED BY $Br^{81}(n,\gamma)Br^{82}$ PROCESS IN ARYL BROMIDES. Slobodanka R. Veljkovic. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 65-70(1957) Mar.

Dilution with organic solvents affects the organic recombination of Br^{82} in aryl and alkyl bromides. Kinetic data suggest the importance of reactions in the epithermal energy range which are affected by the competing thermalizing action of solvents. The viscosity and chemical character of the mixtures influence the amount of the above effect but do not change essentially its character. (auth)

9217

THE SOLUBILITY OF THE POST-TRANSITION METALS IN THEIR MOLTEN HALIDES. John D. Corbett, Samuel von Winbush, and Frank C. Albers (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 3020-4(1957) June 20.

The solubilities of the respective metals in molten PbI_2, $SbCl_3$, SbI_3, $ZnCl_2$, ZnI_2, CdI_2 and $GaBr_2$ are reported. An interpretation of the solution of the post-transition representative metals in their molten halides is presented in terms of the formation of slightly stable subhalides. The apparent stabilities of the lower halides increase both with increasing atomic weight of the metal within a group, and with increasing atomic weight of the halide with a given metal, except for cadmium. The halide effect is attributed to a corresponding decrease in the extent to which the higher oxidation state of the metal is stabilized by complex formation with halide. The relative stabilities of the metal–halide complexes observed parallel those reported in aqueous solution for the same ions, including the inversion in order found for cadmium. The formation of gaseous subhalides of antimony, bismuth and gallium is indicated by transport experiments. A direct correspondence is found between those systems in which gaseous subhalides of appreciable stability are formed and those in which metal dissolves in the molten salt to an appreciable extent. Diamagnetic solutes are formed in the zinc, cadmium, gallium, antimony and bismuth systems. (auth)

9218

HYDROXYBENZENEBORONIC ACIDS AND ANHYDRIDES. Henry Gilman, Ludovico Santucci, D. R. Swayampati, and R. O. Ranck (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 3077-81(1957) June 20.

ortho-, meta- and para-hydroxybenzeneboronic acids and/or anhydrides were prepared by the reaction of tri-n-butyl borate with the corresponding organolithium compounds. The properties of the three "isomers" (boronic acid or anhydride), including anhydride formation ability, were found to vary considerably. The preparation of 2-(m-bromophenoxy)-tetrahydropyran and the optimum conditions for the halogen–metal interconversion of m-bromophenol also are reported. (auth)

9219

PREPARATION AND POLYMERIZATION OF UNSATURATED QUATERNARY AMMONIUM COMPOUNDS. VIII. A PROPOSED ALTERNATING INTRAMOLECULAR-INTERMOLECULAR CHAIN PROPAGATION. George B. Butler and Rudolph J. Angelo (Univ. of Florida, Gainesville). J. Am. Chem. Soc. 79, 3128-31(1957) June 20.

A mechanism is proposed for the polymerization of certain allyl unsaturated quaternary ammonium salts which involves an alternating intramolecular–intermolecular chain propagation leading to the formation of chains of piperidine rings. This mechanism is supported by results obtained using suitable monomers, by studies of solvent, initiator and oxygen effects and by hydrogenation evidence. An estimation of the molecular weight of the polymers has been made. (auth)

9220

METAL–WATER REACTIONS. V. KINETICS OF THE REACTION BETWEEN MAGNESIUM AND WATER VAPOR. Harry J. Svec and Dale S. Gibbs (Iowa State Coll., Ames). J. Electrochem. Soc. 104, 434-9(1957) July.

The rate of reaction between magnesium and water vapor was studied in the temperature range between 425 and 575°C and in the water vapor pressure range between 31 and 208 mm Hg. The reaction took place according to the linear rate law. Rate constants were found to be linearly dependent on the water vapor pressure. The activation energy for the reaction was found to vary with both temperature and water vapor pressure, increasing as the temperature was increased and the water vapor pressure was decreased. This type of variation is explained on the basis of a change from a surface to a vapor phase reaction due to the very large increase in the vapor pressure of Mg metal in the temperature range between 500 and 600°C. (auth)

9221

LUMINESCENCE OF MODIFIED TIN-ACTIVATED STRONTIUM ORTHOPHOSPHATE. H. Koelmans and A. P. M. Cox (Philips Research Labs., Eindhoven, Netherlands). J. Electrochem. Soc. 104, 442-5(1957) July.

The introduction of Al, Zn, Mg, Ca, or Cd in $Sr_3(PO_4)_2$ produces a new crystal phase which is probably isomorphous with $\beta Ca_3(PO_4)_2$. Activated with tin this Sr-orthophosphate gives a strong luminescence with a maximum at about 6300A under excitation with 2537A. (auth)

9222

FACTORS AFFECTING THE SOLUTION OF INORGANIC SALTS IN ORGANIC SOLVENTS. Leonard I. Katzin (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 4, No. 3-4, 187-204(1957).

Inorganic salts are appreciably soluble in organic media, principally of the oxygenated forms (alcohols, ketones, ethers, esters), when they are capable of forming neutral molecules in solution. This property is largely confined to the transition elements. Those of the first long series, and in the trans-radium region, accomplish this without forming undebatably covalent compounds; other subgroup elements which are solvent-soluble show a stronger tendency toward covalent bond formation, and may show solubility in chlorinated hydrocarbons and benzenoid solvents in which the first group mentioned are not usually soluble. The salts of the first three groups of the periodic table generally are not organic-soluble, because their co-ordinative power is relatively low, and their solid lattice energies are high. They tend strongly to approach the point-charge characterization on which the electrostatic approach to aqueous solution chemistry is based. (auth)

AEROSOLS

9223 ANL-5725
Argonne National Lab., Lemont, Ill.
STUDIES OF PARTICLE SIZE DISTRIBUTION IN FLUIDIZED BEDS. H. M. Katz. May 1957. 20p. Contract W-31-109-eng-38. $0.20(OTS).

A technique for the study of distribution of particle sizes in fluidized beds consisting of two particle sizes has been devised, and data have been obtained for a number of such systems. It has been shown that both static electricity in the bed and surface adsorption of moisture affect the particle size distribution. Experimental data indicate that the effects of these variables can be eliminated by use of a conducting column of conducting particles and the use of dry air for fluidization. In addition, a qualitative relationship between minimum fluidizing velocity for mixed particle sizes and pressure drop across the bed has been demonstrated. (auth)

ANALYTICAL PROCEDURES

9224 CF-56-10-86
Oak Ridge National Lab., Tenn.
EXTRACTION OF CHROMIUM WITH TRIOCTYLPHOSPHINE OXIDE FROM ACIDIC SOLUTIONS OF ALKALI METAL SALTS AND ITS DETERMINATION IN SITU AS THE CHROMIUM–DIPHENYLCARBAZIDE COMPLEX. C. K. Mann and J. C. White. Oct. 23, 1956. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

9225 HW-30589(Pts. I and II)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
REACTOR SECTION STANDARD ANALYTICAL METHODS. July 1954. Decl. Mar. 14, 1957. 196p. Contract [W-31-109-Eng-52]. $30.30(ph OTS); $8.70(mf OTS).

Standard analytical methods for water, boiler water, cotton plug filters, lubricating oils, gases, silica, and essential materials are given. (T.R.H.)

9226 IGO-AM/W-88
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF ALKALINITY IN NATURAL WATER, BOILER FEED WATER AND TREATED WATER. May 28, 1957. 3p.

The filtered sample is titrated with H_2SO_4 to end points using phenolphthalein and screened methyl orange as indicators. (auth)

9227 IGO-AM/W-90
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF CALCIUM AND MAGNESIUM HARDNESS IN NATURAL, TREATED, BOILER FEED AND BOILER WATERS (E.D.T.A. TITRATION). May 28, 1957. 5p.

The sample is titrated with a standardized EDTA solution to end points with Solochrome Black and with Murexide. A specialized treatment for highly colored waters is included. (auth)

9228 IGO-AM/W-91
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF TRACE AMOUNTS OF CALCIUM AND MAGNESIUM HARDNESS IN NATURAL, TREATED, BOILER FEED AND BOILER WATERS (E.D.T.A. TITRATION). May 28, 1957. 5p.
(See preceding abstract.)

9229 IGO-AM/W-93
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF BORON IN METHANOL AND IN METHANOL DISTILLATES ARISING FROM BORON SEPARATION PROCEDURES (CURCUMIN-CHLOROPHENOL METHOD). May 27, 1957. 7p.

The methanol is removed by evaporation, and B in the residue is determined absorptiometrically using curcumin in the presence of orthochlorophenol, perchloric acid, and acetic anhydride. (auth)

9230 IGO-AM/W-94
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION OF THE SURFACE LEAD AND CADMIUM CONTAMINATION ON STAINLESS STEEL TUBING (POLAROGRAPHIC METHOD). May 5, 1957. 5p.

9231
PREWAVES AND POSTWAVES IN THE POLAROGRAPHY OF PHENYL KETONES. Philip J. Elving and Joseph T. Leone (Univ. of Michigan, Ann Arbor). Anal. Chem. 29, 782-4(1957) May.

9232
THE DETERMINATION OF RUBIDIUM AND CAESIUM IN ROCKS, MINERALS AND METEORITES BY NEUTRON-ACTIVATION ANALYSIS. M. J. Cabell and A. A. Smales (Atomic Energy Research Establishment, Harwell, nr. Didcot, Berks). Analyst 82, 390-406(1957) June.

A method is described for the determination of rubidium and cesium in rocks, minerals, and meteorites by neutron-activation analysis. Except that simple precautions must be taken to eliminate the possibility of self-shielding of samples and standards during neutron irradiation, the results are not subject to interference by other constituents of the sample. Each determination requires 15 to 300 mg of sample. After irradiation radiochemical separations with carriers present are based on ferric hydroxide scavenges, cobaltinitrite precipitations, and cation-exchange chromatography. The purified rubidium and cesium fractions are finally recovered for counting as their chloroplatinates. The samples examined have varied from 3.4 to 4×10^{-6} % in rubidium content and from 7.5 to 1×10^{-6}% in cesium content. They include an international inter-comparison suite of lepidolites, the two international standard rocks W1 and G1, samples from the Skaergaard intrusion of East Greenland, and several meteorites. Except at the lower end duplicate or triplicate determinations of rubidium contents usually agree within 5% and often within 2%. Agreement between the results for cesium is rather less good. When it has been possible to compare results with those obtained by other methods, agreement has been excellent. (auth)

9233

POLAROGRAPHIC DETERMINATIONS OF THORIUM. R. P. Graham and G. B. Larrabee (Hamilton Coll., McMaster Univ., Ontario, Can.). Analyst 82, 415-22 (1957) June.

Indirect polarographic methods for the determination of thorium are described. These depend on the precipitation of thorium by either m-nitrobenzoic acid, m-nitrophenylarsonic acid, or 8-hydroxyquinoline, the dissolution of the separated and washed compound, and then the polarographic determination of the regenerated organic reagent. The pH conditions required for the precipitations by the reagents and appropriate for their polarographic determination are discussed. The method with m-nitrobenzoic acid, in which thorium is precipitated as the tetra-(m-nitrobenzoate), has been shown to be applicable to the determination of thorium in magnesium alloys containing zinc and rare-earth elements. (auth)

9234

POLAROGRAPHIC-AMPEROMETRIC DETERMINATION OF Hg, Ag, Au, Fe AND V; DETERMINATION OF VANADIUM IN URANIUM. Milenko V. Šušić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 25-8(1957) Mar.

On the basis of the chemical behavior of Hg^{2+}, Ag^{+}, Au^{3+}, Fe^{3+}, and V^{5+} ions towards ascorbic acid in presence of non-complexing electrolytes, we have investigated the determination of these elements using the polarograph as a null-detection instrument for measurement of diffusion current, and ascorbic acid as a reducing agent. (auth)

9235

SPECTROCHEMICAL DETERMINATION OF IMPURITIES IN URANIUM. Dimitrije S. Pešić, Vladimir M. Vukanović, Slobodan N. Marinković, and Momir D. Marinković. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 71-7(1957) Mar.

A method has been developed of the spectrochemical analysis of U_3O_8 for certain, in nuclear-chemical respect interesting elements, without previous separation. The procedure for qualitative detection of B, Cd, V, Mo, Mn, Fe, Cr, Cu, Ni, Li, the semi-quantitative determination of V, Mo, Mn, Fe, Cr, Cu, Ni, Li, and quantitat.ve determination of B and Cd has been described. A detectability of 0.05 ppm for B, 0.1 ppm for Cd, 1 ppm for Fe, Cr, Cu, V, Li, 2 ppm for Mn, 3 ppm for Mo and 5 ppm for Ni has been obtained. B and Cd have been determined quantitatively in the range of concentration of 0.5 to 20 ppm with standard deviations of 7% for B and 11% for Cd. (auth)

9236

INVESTIGATION OF COMPLEX COMPOUNDS OF THORIUM WITH AMINOPOLYCARBONIC ACIDS BY MEANS OF HIGH FREQUENCY TITRATION. D. I. Ryabchikov and B. K. Belyaeva (Vernadskiĭ Moscow Inst. of Geochemistry and Analytical Chemistry). Zhur. Analit. Khim. 12, 166-75(1957) Mar.–Apr. (In Russian)

The preparative high-frequency titration methods used in the investigation showed that thorium forms complex compounds $(NH_4)_2ThX_2 \cdot 4H_2O$ with nitrilotriacetic acid and $(NH_4)_2ThUr_2 \cdot 4H_2O$ with uramyldiacetic acid pH 8.2 when the molar ratio of Th to addendum is 1:2. Thorium forms complex compounds $NH_4(Th\gamma OH) \cdot 4H_2O$ with ethylenediaminetetraacetic acid at pH 7.0 and $NH_4[Th(CH_2)_4OH] \cdot 5H_2O$ with 1.2 diaminocyclohexanetetraacetic acid at pH 8.0 when the molar ratio of thorium to addendum is 1:1. (tr-auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

9237

ON THE CRYSTAL STRUCTURES OF THE MAGNUS SALTS, $Pt(NH_3)_4PtCl_4$. Masao Atoji, James W. Richardson, and R. E. Rundle (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 3017-20(1957) June 20.

The crystal structure of the Magnus green salt, $Pt(NH_3)_4PtCl_4$, is tetragonal, a = 9.03 A and c = 6.49 A, with space group D_{4h}^8–P4/mnc, and two formula units per unit cell, showing that the structure previously reported is incorrect. The planar $Pt(NH_3)_4^{2+}$ and $PtCl_4^{2-}$ ions are stacked over one another along the c-axis with Pt–Pt distance, c/2 = 3.25 A. The bond distances of Pt–Cl = 2.34 A and Pt–N = 2.06 A are obtained with high accuracy by means of the generalized Fourier synthesis. The interatomic distances and the infrared spectrum indicate no significant NH . . . Cl hydrogen bonding in this compound. The comparison between the radial distribution functions of this salt and its isomeric pink salt reveals that there is no direct Pt–Pt contact in the Magnus pink salt, but other distances are comparable. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

9238

METHODS FOR ISOTOPIC ANALYSIS OF WATER. III. THE COMPLETE ISOTOPIC ANALYSIS OF WATER BY DECOMPOSING WITH IRON. A. I. Shatenshtein and Ya. M. Varshavskiĭ (Karpov Moscow Physico-Chemical Inst.). Zhur. Analit. Khim. 12, 236-9(1957) Mar.–Apr. (In Russian)

A rapid semi-micro method for complete isotopic analysis of water is described. In combination with the drop determination of density the method permits separate determination of heavy isotopes of O and H (deuterium) in samples with any content of deuterium. (tr-auth)

9239

PARAMAGNETIC RESONANCE OF PRODUCTS FORMED AT LOW TEMPERATURES BY THE DISSOCIATION IN THE GLOW DISCHARGE OF H_2O, H_2O_2, D_2O VAPORS. I. Gorbanev, S. D. Kaitmazov et al. (Lebedev Inst. of Physics). Zhur. Fiz. Khim. 31, 515(1957) Feb. (In Russian)

FLUORINE AND FLUORINE COMPOUNDS

9240 BMI-1186

Battelle Memorial Inst., Columbus, Ohio.

VAPOR PRESSURE AND EQUILIBRIUM STUDIES OF THE SODIUM FLUORIDE–BERYLLIUM FLUORIDE SYSTEM. Karl A. Sense, Richard W. Stone, and R. B. Filbert, Jr. May 27, 1957. 32p. Contract W-7405-eng-92. $6.30 (ph OTS); $3.00(mf OTS).

A new study made on the vapor pressure of BeF_2 over the temperature interval 802 to 1025°C showed good agreement with previous data taken over the 802 to 968°C range. Excessive scatter of the vapor-pressure data in the lower temperature region prevented a melting-point determination of BeF_2 by the transpiration method alone. Thermal analysis showed the melting point to be about 545°C. Vapor pressures of the NaF-BeF_2 system were measured over the range 509 to 1061°C. On the basis of previously developed theory it was concluded that the complex $NaBeF_3$ exists in the vapor phase in addition to NaF and BeF_2. Resolution of the vapor phase on this basis led to the disclosure that another complex must exist in the vapor phase. This additional complex was postulated as being Na_2BeF_4. In the absence of enough equations to solve for all the unknowns, a system of partial pressures was approximated within the framework of the experimental data. This system was made self-consistent with respect to smoothed plots of the equilibrium constants as functions of temperature. A liquid-vapor phase diagram and plots showing how the total pressure varies with the composition are presented. (auth)

9241 KAPL-M-POS-2
Knolls Atomic Power Lab., Schenectady, N. Y.
ANOMALOUS PLANE-GEOMETRIC VOIDS IN IRRADIATED LiF AT ELEVATED TEMPERATURES. P. Senio and C. W. Tucker, Jr. Mar. 26, 1957. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Irradiated LiF single crystals that have been annealed at elevated temperatures become populated with thin square and rectangle shaped voids. These voids are presumed to be a result of fission gas agglomeration and the subsequent trapping of lattice vacancies. The void population depends qualitatively on integrated thermal neutron exposure, and annealing time and temperature. (auth)

9242
INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHYLENES. VII. 1, 1-DIFLUORO-2, 2-DIBROMOETHYLENE. Rose Theimer and J. Rud Nielsen (Univ. of Oklahoma, Norman). J. Chem. Phys. 26, 1374-7(1957) June.

The infrared absorption spectrum of gaseous $CF_2 = CBr_2$ has been obtained with a Perkin-Elmer Model 112 double-pass spectrometer equipped with NaCl and CsBr prisms and with a 1-m cell. The Raman spectrum of the compound in the liquid state was photographed with a 3-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. Polarization ratios were measured for the stronger Raman bands. The observed spectra have been interpreted in detail. Thermodynamic properties of the compound in the ideal-gaseous state were calculated for 4 temperatures above the boiling point. (auth)

9243
RAMAN SPECTRUM OF GASEOUS 1-FLUORO-1-CHLOROETHYLENE. J. Rud Nielsen and J. C. Albright (Univ. of Oklahoma, Norman). J. Chem. Phys. 26, 1566-7(1957) June.

The Raman spectrum of gaseous $CFCl = CH_2$ has been obtained with the aid of a multiple-reflection Raman tube and a 3-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. All but one of the 12 vibrational fundamentals and several overtone or combination bands have been measured. The results are discussed. (auth)

9244
ELECTRONIC SPECTRUM AND DISSOCIATION ENERGY OF FLUORINE. A. L. G. Rees (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia). J. Chem. Phys. 26, 1567-71(1957) June.

The continuous absorption spectrum of molecular fluorine and the Raman displacement for the $0 \rightarrow 1$ vibrational transition have been used to compute the potential energy curve for the repulsive $^1\Pi_u$ state dissociating to two normal fluorine atoms. This curve is consistent with a value of 37.1 ± 0.85 kcal/mole for the dissociation energy of the ground state. A weak absorption, attributed, on the grounds of location and intensity, to $^3\Pi_{0^+u} \leftarrow {}^1\Sigma_g{}^+$, has been shown to occur in the long wavelength region of the main absorption and a segment of the potential energy curve for $^3\Pi_{0\ u}$ has been deduced. Absorption curves, calculated from the potential energy curves and the ground-state anharmonic eigenfunctions, fit the observed data satisfactorily. (auth)

GRAPHITE

9245 ANL-5693
Argonne National Lab., Lemont, Ill.
INTERSTITIAL COMPOUNDS OF IRRADIATED GRAPHITE. G. R. Hennig and G. L. Montet. Mar. 1957. 30p. Contract W-31-109-eng-38. $0.25(OTS).

As the result of an attempt to prepare unordered compounds of graphite containing more than 1.5×10^{-3} acceptor per carbon atom by the introduction of both chemical acceptors and radiation damage centers, evidence has been found for mutual destruction of chemical acceptors and damage centers. An analysis of the kinetic behavior of the mutual destruction indicates that the extent of destruction is independent of the order in which the radiation damaging and chemical treatments are carried out. From some auxiliary experiments made necessary by the discovery of the above interaction it is concluded that the graphite bisulfate residue compounds are stable at room temperature, and that the bisulfate ion is not appreciably decomposed by the gamma flux in the reactor during short irradiations. The dependence of some electrical properties of graphite on the concentrations of both chemical acceptors and radiation damage centers has been analyzed on the basis of the two-band theory of a semi-conductor above its degeneracy temperature. It is concluded that, whereas the Hall effect may be reasonably well understood, the behaviors of the electrical resistance and magnetoresistance cannot be understood in terms of this theory, so that the introduction of additional hypotheses appears necessary. (auth)

LABORATORIES AND EQUIPMENT

9246
SOME FACILITIES FOR THE STUDY OF PLUTONIUM AND ITS ALLOYS. G. K. Williamson, D. M. Poole, and J. A. C. Marples (Atomic Energy Research Establishment, Harwell, Berks). J. Inst. Metals 85, 431-6(1957) June.

Five glove-boxes for the safe handling of the highly toxic and reactive metal plutonium and its alloys are described. Facilities are provided for alloy preparation, x-ray examination, heat treatment, and metallography. The apparatus is simple, is easy to use, requires little maintenance, and can readily be modified and extended whenever necessary. (auth)

RADIATION CHEMISTRY

9247
DECOMPOSITION OF CARBON DIOXIDE BY IONIZING RADIATION. PART II. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Chem. Phys. 26, 1727-33(1957) June.

Research on CO_2 was conducted at pressures from 1 to 50 atm, and on liquid carbon dioxide at 10°C, near the critical temperature. Also a novel method was developed in using the direct impact of the fission fragments on the gases (uranium-235 in contact with the gases on bombardment with thermal neutrons). The action of inhibitors other than NO_2 to stop the back reaction of the decomposed carbon dioxide was also investigated. (auth)

9248
REACTION OF CARBON MONOXIDE AND OZONE.
P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Chem. Phys. 26, 1734-7(1957) June.

The reaction between O_3 and CO has been investigated at 35°, 100°, 180°, and 258°C. It could be shown that there is an initial period where the reaction proceeds an order of magnitude faster than after some CO_2 is formed. Further oxidation of CO by O_3 proceeds in the order of magnitude of the thermal decomposition of O_3. (auth)

9249
OXIDATION OF FERROUS SULFATE BY HIGH-ENERGY ELECTRONS AND THE INFLUENCE OF THE POLARIZATION EFFECT. J. Zsula, A. Liuzzi, and J. S. Laughlin (Sloan-Kettering Inst., New York). Radiation Research 6, 661-5(1957) June.

The oxidation of the ferrous ion in dilute solution

produced by high-energy electrons with primary energies of 6.3 and 16.0 Mev was measured. The ionization produced in air under identical conditions was also measured. If the polarization effect is included in the dosimetry analysis, the G values obtained with each energy of electron employed (15.5 ions per 100 ev at 6.3 Mev; 15.7 ions per 100 ev at 16 Mev) are essentially the same as that obtained with Co^{60} γ rays. If the polarization effect is ignored, the G values for the different energies of electrons differ from each other and from values obtained with x rays and γ rays by amounts well beyond experimental uncertainty. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

9250

PRASEODYMIUM OXIDES. IV. A STUDY OF THE REGION $PrO_{1.83}-PrO_{2.00}$. C. L. Sieglaff and L. Eyring (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 79, 3024-6(1957) June 20.

This is a study of the phase relationships of the higher praseodymium oxides. X-ray powder diagrams of quenched, analyzed samples were taken to determine the phases present. A two-phase system was found for the region $PrO_{1.83}-PrO_{2.00}$ at preparation temperatures below 350° and oxygen pressures less than ten atmospheres. Lattice constants are given for the various phases found. (auth)

9251

DIMERIZATION OF SOLID GROUP IIIB TRIHALIDES. III. BROMINE, GALLIUM, AND INDIUM QUADRUPOLE RESONANCES IN $GaBr_3$, GaI_3, $InBr_3$, AND InI_3. R. G. Barnes and S. L. Segel (Iowa State Coll., Ames) and P. J. Bray and P. A. Casabella (Brown Univ., Providence, R. I.). J. Chem. Phys. 26, 1345-6(1957) May.

9252

MECHANISM FOR THE REDUCTION OF CERIC ION BY FORMIC ACID INDUCED BY COBALT-60 GAMMA-RADIATION. Thomas J. Sworski (Oak Ridge National Lab., Tenn.). Radiation Research 6, 645-52(1957) June.

In the radiolysis of air-saturated H_2SO_4 solutions containing ceric ion-cerous ion-formic acid mixtures at constant initial $(Ce^{3+})/(HCOOH)$, the initial $G(Ce^{3+})$ decreases with decreasing total concentration of cerous ion and formic acid. These data are quantitatively interpreted by the assumption that cerous ion, formic acid, and H_2SO_4 compete with each other for reaction with OH radical. Although the OH radical reacts with both cerous ion and formic acid, it is assumed that the HSO_4 radical (formed by reaction of OH radical with sulfuric acid) oxidizes cerous ion but does not react with formic acid. Thus, kinetic evidence is presented for an influence of H_2SO_4 on reactions of OH radical in sulfuric acid solutions. (auth)

SEPARATION PROCEDURES

9253 AECD-4239

Argonne National Lab., Lemont, Ill.

APPLICATIONS OF FLUORIDE VOLATILITY PROCESSES TO FEED MATERIALS. R. K. Steunenberg and R. C. Vogel. [Feb. 1956]. Decl. with deletions Feb, 26, 1957. 11p. Contract [W-31-109-eng-38]. $0.15(OTS).

The application of a fluoride volatility process to feed materials is considered. The most promising prospect is in recovery of U from MgF_2-U slags. An interesting application is in recovery of U from ore concentrates. Although these schemes appear attractive, their possibilities are limited by F_2 technology. (T.R.H.)

9254 KAPL-1693

Knolls Atomic Power Lab., Schenectady, N. Y.

RECOVERY OF URANIUM FROM FUSED SALT MELTS BY ELECTRODEPOSITION. L. W. Niedrach and G. R. Fountain. Mar. 29, 1957. 18p. Contract W-31-109-Eng-52. $0.20(OTS).

An electrolytic method is described for recovering U values from waste salts from an electrorefining process for reactor fuels. The behavior of U and representative active metal fission product elements in such a process is described. (auth)

9255 KLX-10066

Vitro Labs., West Orange, N. J.

FISSION PRODUCT SEPARATIONS STUDY. Quarterly Progress Report [for] December 1, 1956–February 28, 1957. Vitro Job 2077. R. A. Keeler, C. J. Anderson, and M. Kibrick. Mar. 31, 1957. 26p. For [Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract No. 994. $0.35(OTS).

Study of the solubility of $SrSO_4$ in H_2O and in HNO_3 at 0 to 350°C was continued. Results indicate that the solubility of $SrSO_4$ in H_2O decreases with increasing temperature, whereas in HNO_3 it increases with temperature. Tests were conducted with 5M HNO_3 to illustrate the effect of coprecipitating agents. The feasibility of using a $SrSO_4$ precipitation process for the decontamination of acid wastes is discussed. Selected minerals were evaluated in room-temperature batch tests as inorganic exchangers for removing Cs and Sr from 2.5M and 7.0M HNO_3. (For preceding period see KLX-10057.) (W.L.H.)

9256 NYO-7936

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATIONS TO DETERMINE THE FEASIBILITY OF ULTRASONIC LIQUID-LIQUID EXTRACTION. J. L. Straughn and W. B. Tarpley. Feb. 1957. 66p. Contract AT(30-1)-1798. $10.80(ph OTS); $3.90(mf OTS).

Ultrasonic emulsification followed by ultrasonic emulsion breaking as an approach to mixer-settler contactors for liquid-liquid extraction was explored with a number of liquid systems, including $UO_2(NO_3)_2-HNO_3$ and TBP in kerosene, and the laboratory feasibility of an ultrasonic multistage extractor was established. An ultrasonic mixer array was devised, permitting the production of dispersed droplets in the order of 2 μ diameter and demonstrating an extraction efficiency of 85 to 99% at flow rates as high as 100 ml/min with the above systems. Continuous-flow emulsion-breaker studies established the laboratory feasibility of this step, and successful emulsion breaking was achieved at flow rates up to 60 ml/min. Frequencies for satisfactory ultrasonic mixing are in the range of 10 to 30 kc, while those for emulsion breaking appeared to be in the vicinity of 300 kc. High-intensity vibration to produce these effects is generated by electrostrictive or magnetostrictive transducers operating at the end of metal coupler rods. Means are available for sealing these couplers into vessels, permitting isolation of radioactive solutions without serious energy loss. Multiple treatment heads can be operated from a single ultrasonic generator which can be remote from the treatment heads. New concepts involving ultrasonic application to columnar treatment units are discussed, and further work along these lines is suggested. Experimental application to specific problems at reactor sites is indicated by this program. (auth)

9257 ORNL-2308

Oak Ridge National Lab., Tenn.

URANIUM RECOVERY FROM ORE BY A HIGGINS ION-EXCHANGE CONTACTOR AT GRAND JUNCTION PILOT PLANT. C. W. Hancher, I. R. Higgins, and J. S. Taylor.

July 1, 1957. 29p. Contract W-7405-eng-26. $0.25 (OTS).

The 12-in.-diam Higgins continuous ion-exchange contactor satisfactorily processed 180 tons of Dysart ore over an operating period of 13 days. The U loss ranged from 0.001 to 0.004 g of U_3O_8 per liter with an average loss of 0.002 g/liter (0.2% loss). The final U product quality exceeded that normally produced. The maximum sustained processing rate was 16 tons of ore per day with all units in the system operating at 200% of design capacity. (auth)

9258

PERFORMANCE OF PACKED COLUMNS. IV. EFFECT OF GAS PROPERTIES, TEMPERATURE, AND PRESSURE ON GAS-PHASE MASS TRANSFER COEFFICIENTS. H. L. Shulman and J. E. Margolis (Clarkson Coll. of Tech., Potsdam, N. Y.). A.I.Ch.E. Journal 3, 157-61(1957) June.

Naphthalene Berl saddles were vaporized into air, CO_2, and Freon-12 in a 4.0-in. column. Temperatures from 15 to 73°C. and pressures from 0.26 to 1 atm. were covered. Correlation was found which represented all the experimental data when the surface temperature of the naphthalene was used to evaluate the correct driving force. This correlation, when combined with effective interfacial areas presented previously, makes it possible to estimate the volumetric mass transfer coefficient, k_Ga, for any gas-liquid-solute system. (auth)

9259

ION EXCHANGE SEPARATION OF GRAM QUANTITIES OF AMERICIUM FROM A KILOGRAM OF LANTHANUM. D. E. Armstrong, L. B. Asprey, J. S. Coleman, T. K. Keenan, L. E. LaMar, and R. A. Penneman (Los Alamos Scientific Lab., N. Mex.). A.I.Ch.E. Journal 3, 286-8(1957) June.

The separation of 4.5 g. of Am from ~1 kg of light rare earths (primarily La) was achieved on a pilot plant scale by chromatographic displacement of the mixture from Dowex-50 resin with 0.1% ammonium citrate at pH 8 into hydrogen-form Dowex-50. The Am collected into a narrow band and was eluted free from La but contained an equal weight of Ce. A 6- and a 2-in.-diam. column were used in tandem. Use of a final column with a much smaller diameter would have permitted a cleaner separation from Ce, but this was left for a laboratory-scale separation by a different process. Precipitation, which was observed in the columns during the first runs, was later avoided entirely by use of high flow rates both initially and during the transfer between columns. No adverse effects were noted from ~15 curies of alpha activity. (auth)

9260

THE SEPARATION OF BERYLLIUM FROM IRON, ALUMINIUM AND TITANIUM BY ION EXCHANGE, AND ITS APPLICATION TO THE ANALYSIS OF BERYL. M. N. Nadkarni, M. S. Varde, and V. T. Athavale (Atomic Energy Establishment, Bombay, India). Anal. Chim. Acta 16, 421-5(1957) May.

A new ion exchange method is proposed for the separation of Be from Al, Fe, Ti, Ca and phosphate, by preferentially adsorbing it on cation exchange resin Amberlite IR-120, after complexing the other ions with EDTA and H_2O_2. The successful application of the method to the analysis of beryls is demonstrated. (auth)

9261

SEPARATION OF URANIUM FROM RARE EARTHS AND SOME OTHER ELEMENTS BY SOLVENT EXTRACTION WITH TRI-BUTYL PHOSPHATE. Milenko V. Šušić and Nikola Jelić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 29-33(1957) Mar.

The use of 20% TBP in kerosene as an extracting agent for the separation of U from rare earths and other elements, from 2 N nitric acid solution was studied. The dependence of the distribution coefficients of U, rare earths and other elements on their respective concentrations in solution was investigated, as also the influence of the concentration of TBP in kerosene on the distribution coefficient of U. For the investigations with rare earths, radioactive isotopes of Ce^{144} and Eu^{152} were employed. (auth)

9262

SEPARATION OF URANIUM FROM RARE EARTHS AND SOME OTHER ELEMENTS IN SULPHURIC ACID MEDIUM, USING ANION EXCHANGE RESIN. Milenko V. Šušić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 35-8(1957) Mar.

The ability of U to form complexes with dilute H_2SO_4 solutions affords a method for the separation of U from rare earths and some other elements by adsorption on anion exchange resins. From very dilute H_2SO_4 solutions (>1 N H_2SO_4) U is quantitatively adsorbed on the resin, but the other elements pass through column without being adsorbed as they do not form sulfate complexes. (auth)

9263

SEPARATION OF Te, Ru, Cs AND RARE EARTHS FROM ONE ANOTHER, USING ANION EXCHANGE RESIN DOWEX-1. Milenko V. Šušić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 39-41(1957) Mar.

The separation of Te, Ru, Cs, and rare earths from one another, using the anion exchange resin Dowex-1 is studied. The behavior of each of the elements in alkaline medium is different. Tellurium, Cs, and Ru do not precipitate, while rare earths form sparingly soluble hydroxides. Rare earths can be separated from other elements by filtration. The solution containing the remaining elements is passed through the column. Tellurium and Ru are adsorbed in the column, Cs and trace quantities of rare earths pass through it. (auth)

9264

INFLUENCE OF TEMPERATURE ON THE EXTRACTION OF URANYL NITRATE WITH TRIBUTYL PHOSPHATE AT VARYING CONCENTRATIONS OF NITRIC ACID. Zdenko I. Dizdar, Olga S. Gal, and Jelena K. Rajnvajn. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 43-8(1957) Mar.

The dependence of the mass partition coefficient (μ) of $UO_2(NO_3)_2$ on temperature (1° to 80°C) is determined for the system: aqueous solution of HNO_3 – 30% TBP (diluted with dibutyl ether), at different HNO_3 concentrations. It is found that μ decreases with increasing temperatures at all acid concentrations. For a definite concentration of HNO_3, μ is logarithmically related to the temperature. Change in volume and optical transmittancy and decrease in the acidity of the aqueous phase show that the two phases chemically interact to an extent which rises with temperature and acid concentration. The limit of stability at 20°C is at 6M HNO_3, but changes to 4M HNO_3 at 80°C. (auth)

9265

SEPARATION OF Ce AND Eu FROM URANIUM BY ORGANIC COPRECIPITANTS. Zoran B. Maksimović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 49-52 (1957) Mar.

The separation of Ce and Eu from uranium by the method of organic coprecipitation is studied. It is found that Ce and Eu can be quantitatively coprecipitated, with diphenyl-44'-bis[<azo4>-1-oxybenzene-2-sulfonic acid] and methyl, violet in the presence of ammonium carbonate as complexing agent for U. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

9266 UCRL-3772

California. Univ., Berkeley. Radiation Lab.

SOME ASPECTS OF THE RESEARCH ON TRANSCURIUM

ELEMENTS AT BERKELEY. Stanley G. Thompson. Apr. 19, 1957. 26p. Contract [W-7405-eng-48]. $4.80(ph OTS); $2.70(mf OTS).

URANIUM AND URANIUM COMPOUNDS

9267 GAT-L-366
Goodyear Atomic Corp., Portsmouth, Ohio.
FLUORINATION OF RECOVERY OXIDE. G. A. Rampy. June 5, 1957. 18p. Contract [AT(33-2)-1]. $3.30(ph OTS); $2.40(mf OTS).

Due to deterioration of equipment in the conversion of UO_3 to UF_6 by fluorination at 1000°C, investigations were begun on lowering the reaction temperature there by eliminating deterioration. At 530°C ~33% excess F_2 was required to completely convert the UO_3 to UF_6. Using 11% excess F_2, conversion was found to increase rapidly from 200 to 450° and level out slightly above 450°C. (W.L.H.)

9268 IGR-TN/W-517
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE OXIDATION OF URANIUM IN ARGON CONTAINING TRACES OF OXYGEN. D. Shaw and P. Hindmarch. Apr. 1957. 11p.

The rates of oxidation of U in A containing up to 50 ppm O_2 at temperatures up to 900°C have been investigated. The O_2 content of the A was measured using an electrolytic cell method. The rates of oxidation in A containing up to 10 ppm O_2 were considerably less, proportionally, than the rates obtaining at 30 and 50 ppm O_2. The rates of oxidation at 600 and 900°C were similar, but at 300°C the rate was appreciably less. The results indicated that the initial rate of oxidation is slow but increases to become linear with time after the oxide thickness exceeds a certain value. (auth)

9269 KAPL-1765
Knolls Atomic Power Lab., Schenectady, N. Y.
THE ACTION OF MOLTEN URANIUM ON GRAPHITE. E. L. Swarts. Apr. 9, 1957. 23p. Contract W-31-109-Eng-52. $0.25(OTS).

An approach was developed for studying the long-term interaction between molten U and graphite in the temperature range 1150 to 1400°C. Preliminary results indicate that in this system an adherent, protective carbide coating forms on the graphite at a rate strongly dependent upon the temperature. (auth)

9270 NLCO-671
National Lead Co. of Ohio, Cincinnati.
THE SUBLIMATION OF URANYL FLUORIDE IN THE PRESENCE OF HYDROGEN FLUORIDE. Richard E. DeMarco, Robert C. Abbott, DuWane C. Bonfer, and Paul A. Cook. Mar. 26, 1957. 15p. Contract AT(30-1)-1156. $0.20(OTS).

Uranyl fluoride was found to sublime in the presence of HF at temperatures greater than 1000°F. The rate of sublimation was found to be 1.35 order with respect to HF and to possess an activation energy of 23 ± 1 kcal/mole. The chemical composition of the volatile compound formed in sublimation was not established. (auth)

9271 NLCO-675
National Lead Co. of Ohio, Cincinnati.
A KINETIC STUDY OF THE REACTION, $UO_2 + 4HF \rightarrow UF_4 + 2H_2O$. PART I. DEVELOPMENT OF THE RATE EQUATION. Richard E. DeMarco, DuWane C. Bonfer, and Robert C. Abbott. Apr. 18, 1957. 27p. Contract AT(30-1)-1156. $0.25(OTS).

A study has been made of the rate-controlling factors in the hydrofluorination of UO_2. A rate equation is proposed for the hydrofluorination reaction which is dependent on the UO_2 concentration and the rate of diffusion of HF through the UF_4 formed to the UO_2 interface. An Arrhenius-type equation expresses the dependence of the observed reaction rate on the hydrofluorination temperature. An activation energy of 8 kcal/mole was calculated, from this equation, for the hydrofluorination reaction. (auth)

9272
SPECTROPHOTOMETRIC STUDY OF THE URANYL COMPLEX OF REDUCTONE. Jolanda M. Hojman. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 17-24(1957) Mar.

It was found that reductone gives a reddish-brown colored complex with uranyl ion, similar to l-ascorbic acid and dihydroxymaleic acid. The complex is stable in weak acid and neutral medium. Its color obeys Beer's law which makes possible the colorimetric determination of the concentration of the uranyl ion as the reductone complex. The effect of reductone on the absorption curve of the uranyl ion in various molar ratios was investigated. The stoichiometric composition of the complex was determined by Job's method. (auth)

9273
PARTIAL AIR OXIDATION OF CHATTANOOGA URANIFEROUS BLACK SHALE. C. R. Kinney and Donald Schwartz (Pennsylvania State Univ., University Park). Ind. Eng. Chem. 49, 1125-30(1957) July.

Because Chattanooga black shale is a potential source of uranium, the associated organic matter was studied. The organic matter has more of the properties of a low-rank coal than of an oil shale. Solvents are ineffective for separating the organic and inorganic constituents, but air oxidation at 200°C followed by alkaline extraction is effective. The resulting humic acids contain an unusually large amount of mineral matter, including a portion of the uranium. The general structure of the humic acids seems to be quinoid with attached carboxyl groups. The organic matter of the oxidized shale can be separated from the mineral components which are cemented together by the organic matter. This suggests separation of the mineral constituents by conventional wet means — differences in specific gravity, flotation, and the like. (auth)

9274
EXTRACTION OF URANYL α-NITROSO-β-NAPHTHOLATE AND SEPARATION OF URANIUM FROM VANADIUM AND IRON. I. P. Alimarin and Yu. A. Zolotov (Lomonosov Moscow State Univ.). Zhur. Analit Khim. 12, 176-80(1957) Mar.–Apr. (In Russian)

The quantitative extraction of U^{6+} from aqueous solutions as α-nitroso-β naphtholate was carried out with organic solvents immiscible with water. The separation of U from V and Fe by means of uranium extraction as α-nitroso-β-naphthalate with isoamyl alcohol from neutral solutions after addition of complexone III is described. (tr-auth)

9275
SPECTRAL DETERMINATION OF URANIUM IN ORES AND THEIR PROCESSED PRODUCTS. N. G. Morozova. Zhur. Analit. Khim. 12, 185-92(1957) Mar.–Apr. (In Russian)

Methods are described for the determination of U in the direct-current arc with copper electrodes. Experiments were made with the direct burning samples (U content >0.02%) or after briquetting samples diluted 10 times with copper (U content >0.1%). To stabilize the arc discharge the briquettes were cooled. The probable error of determination was ±5%. In order to raise the sensitivity of U detec-

tion to 0.005% it was recommended to press or melt the samples before the analysis. (tr-auth)

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

9276 AECU-3501
Columbia Univ., New York.
CONVECTION HEAT TRANSFER AND FLUID FLOW IN DUCTS. Leonard Topper. Mar. 1957. 126p. For Knolls Atomic Power Lab. Contract AT(30-3)-187, Task V. (Cu-30-57-At-187-Ch.E.). $19.80(ph OTS); $6.30(mf OTS).

Theories of fluid flow and heat transfer in channels are presented, with emphasis on aspects that are important in reactor technology. Turbulent flow of high-pressure water through ducts of non-circular section, and circular sections is included. The boundary layer concept and the prediction of connective heat transfer rates from measurements of the velocity profile are given. (W.L.H.)

9277 CF-57-6-111
Oak Ridge National Lab., Tenn.
HEDSTROM PLOT FOR THE CALCULATION OF LAMINAR FLOW PRESSURE DROP FOR BINGHAM PLASTIC MATERIALS WITH HEDSTROM NUMBERS FROM 0 TO 10^{15}. D. G. Thomas. June 20, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The results of a machine calculation of a modified Fanning-friction-factor Hedstrom plot for Hedstrom numbers from 0 to 10^{15} are presented in graphical and tabular form. (auth)

9278 KAPL-1792
Knolls Atomic Power Lab., Schenectady, N. Y.
PREDICTION OF THE PRESSURE LOSS AND DENSITY FACTORS FOR TWO-PHASE ANNULAR FLOW WITH OR WITHOUT HEAT GENERATION. J. C. Westmoreland. Feb. 1, 1957. 35p. Contract W-31-109-Eng-52. $0.30 (OTS).

A simple analysis is presented for predicting pressure loss and density factors for two-phase, one-component annular flow with and without heat generation. All four combinations of laminar and turbulent flow in both the annulus and core are considered. The analysis is based on assumed velocity profiles and matching velocity and shear stress at the liquid vapor interface. The theory is found to compare favorably with experimental results on both vertical and horizontal sections. The application of the theory to natural circulation steam generators is also presented. (auth)

9279
OSCILLATORY BEHAVIOR OF A TWO-PHASE NATURAL-CIRCULATION LOOP. Eugene H. Wissler, H. S. Isbin, and N. R. Amundson (Univ. of Minnesota, Minneapolis). A.I.Ch.E. Journal 2, No. 2, 157-62(1957) June.

A natural-circulation loop with water as the circulating fluid was studied for a range of operation covering two-phase flow. The work reported is concerned with the periodic oscillations of the flow rate and fluid temperature. The oscillations occurred even with constant heat input and constant cooling-water properties for the heat exchanger. The analytical approach includes a theoretical analysis of an open ended system and numerical solutions obtained with an analogue computer for a simplified loop system. Also presented are the equations of motion, continuity, and energy, which were developed for a transient two-phase flow model for adaptation to more detailed numerical evaluations. (auth)

9280
FLOW PAST CIRCULAR CYLINDER WITH A DETACHED SHOCK WAVE. O. M. Belotserkovskiĭ (Computing Center, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 509-12(1957) Mar. 21. (In Russian)

The flat parallel supersonic flow ($M_\infty > 1$) of an ideal gas flowing with constant velocity ω_∞ on a circular cylinder with detached shock wave of unknown shape or position in front of the cylinder was calculated on an electronic computer with satisfactory accuracy. (R.V.J.)

9281
A METHOD OF SOLVING UNSTEADY GAS FLOW EQUATIONS WITH ALLOWANCE FOR DISSIPATIVE PROCESSES IN THE GENERAL THEORY OF RELATIVITY. T. Aitimurzaev (Kirgiz State Univ.). Doklady Akad. Nauk S.S.S.R. 113, 769-72(1957) Apr. 1. (In Russian)

Equations are developed for unsteady relativistic flow of viscous, heat-conducting gas inside of gravitational masses. (R.V.J.)

MATERIALS TESTING

9282 KAPL-M-SAT-4
Knolls Atomic Power Lab., Schenectady, N. Y.
GUIDED BEND TEST AS A MEANS OF QUALIFYING BUTT WELDS IN ZIRCALOY 2 AND 3. S. A. Toftegaard. Apr. 5, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The guided bend test for straight butt joint weldments in Zircaloy-2 and -3 was investigated. Pre-weld annealing enabled good welds to be bent 180°. Increasing the purity of the He atmosphere and modification of the fixture to increase bend radius did not allow welds in cold-rolled Zircaloy to be bent 180°. Welds made with a higher heat input could be bent to specification when the annealed zone embraced the full radius of the bend test plunger. (T.R.H.)

WASTE DISPOSAL

9283 CF-57-3-114(Rev.)
Oak Ridge National Lab., Tenn. and Argonne National Lab., Lemont, Ill.
STATUS REPORT ON THE DISPOSAL OF RADIOACTIVE WASTES. Floyd L. Culler, Jr., and Stuart McLain, comps. and eds. June 25, 1957. 232p. $36.30(ph OTS); $10.20(mf OTS).

A comprehensive survey of waste disposal techniques, requirements, costs, hazards, and long-range considerations is presented. The nature of high level wastes from reactors and chemical processes, in the form of fission product gases, waste solutions, solid wastes, and particulate solids in gas phase, is described. Growth predictions for nuclear reactor capacity and the associated fission product and transplutonic waste problem are made and discussed on the basis of present knowledge. Biological hazards from accumulated wastes and potential hazards from reactor accidents, ore and feed material processing, chemical reprocessing plants, and handling of fissionable and fertile material after irradiation and decontamination are surveyed. The waste transportation problem is considered from the standpoints of magnitude of the problem, present regulations, costs, and cooling periods. The possibilities for ultimate waste management and/or disposal are reviewed and discussed. The costs of disposal, evaporation, storage tanks, and drum-drying are considered. (T.R.H.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

9284

PHYSICO-CHEMICAL AND ELECTRICAL PROPERTIES OF THE TiO_2-ZrO_2 SYSTEM. Ya. M. Ksendzov and V. G. Prokhvatilov. Zhur. Fiz. Khim. 31, 321-7(1957) Feb. (In Russian)

Investigations of the TiO_2-ZrO_2 system phase equilibrium revealed the presence of solid solutions of rutile and ZrO_2 at the boundaries of the system and the formation of a $ZrTiO_4$ compound in the system. At 1400°C, the solid solution of rutile was found between 11 and 12 mol. % of ZrO_2 and tetragonal ZrO_2 was present at about 15% TiO_2. With increasing temperatures the solid solution boundaries shifted towards higher solute concentrations. The electric properties of the system were studied. For $ZrTiO_4$ the value ϵ was 39 and the TK ϵ was 110×10^{-6}. (tr-auth)

CORROSION

9285 AERE-M/M-148

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

METALLURGICAL INVESTIGATIONS OF SODIUM HEAT TRANSFER RIG. 18p. A. G. Ward and J. W. Taylor. Feb. 1957.

A study was made of the attack of stainless steel and Ni by Na, both oxygen-free and contaminated, at temperatures in the range 300 to 600°C in static and dynamic tests. A number of miscellaneous metallurgical investigations on components taken from a stainless steel/Ni double annulus heat exchange rig are also reported. Under the conditions of test, stainless steel of the 18 wt. % Cr–8 wt. % Ni type containing free carbide, undergoes considerable attack, both in static and dynamic tests in Na nominally free from and also heavily contaminated with O_2. From the evidence available it is suggested that the mode of attack consists of a decarburizing action which proceeds intergranularly and modifies the spheroidal carbide in the affected region by diffusion of this phase into the matrix. Under similar test conditions Ni undergoes no detectable corrosion even at the highest temperature. It is recommended that prior inspection be carried out on stainless steel for use in systems containing Na at temperatures above 300°C, to ensure that the steel specification has been fulfilled and, that the material is devoid of free carbide. (auth)

9286 ANL-5530

Argonne National Lab., Lemont, Ill.

THE HIGH TEMPERATURE AQUEOUS CORROSION OF URANIUM ALLOYS CONTAINING MINOR AMOUNTS OF NIOBIUM AND ZIRCONIUM. J. E. Draley, S. Greenberg, and W. E. Ruther. Apr. 1957. 45p. Contract W-31-109-eng-38. $0.35(OTS).

Alloys of U with Nb show good corrosion resistance in degassed, distilled water to about 315°C. The alloys must be quenched from the gamma phase in order to have high temperature corrosion resistance. The corrosion resistance is destroyed by over-aging of temperatures as low as 350°C. Of those tried, the alloy with best resistance to thermal aging is the U–5% Zr–1.5% Nb alloy. At 290°C, optimum heat treatment can result in a rate of corrosion of about 6 $mg/cm^2/day$. Certain moderate aging treatments, e.g., 400°C for two hours, result in improved corrosion resistance in the initial stages of corrosion. Alloys containing 3% Nb and small amounts of Sn show promise. In addition to aging, the alloys are also sensitive to H_2 content. Ultimate corrosion failure is believed due to absorption of corrosion product H_2. (auth)

9287 CF-57-5-71

Oak Ridge National Lab., Tenn.

SUMMARY OF CORROSION DATA FOR HRT MOCKUP OPERATIONAL PERIOD ENDING NOVEMBER 5, 1956. R. E. Wacker and J. C. Griess. May 22, 1957. 49p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

The operation of the HRT mockup was on 0.042m UO_2SO_4, 0.024m H_2SO_4, and 0.005m $CuSO_4$ at 280°C and 1400 psi pressure, with the O_2 content at near 500 ppm. The pump showed bearing wear and high corrosion. The letdown heat exchanger was removed from the mockup and sectioned. The metallographic examination revealed corrosion. Results of corrosion runs on Ti, zircaloy-2, and stainless steel are given. (W.L.H.)

9288 CF-57-5-98

Oak Ridge National Lab., Tenn.

STRESS CORROSION IN THE HRT MOCKUP. P. H. Harley. May 20, 1957. 20p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Stress corrosion was found in 8 components of the HRT mockup; only four of these actually shut down the loop. All of the failures have occurred in the high-pressure system of the loop. (W.L.H.)

9289 CF-57-6-49

Oak Ridge National Lab., Tenn.

HRP IN-PILE CORROSION TEST LOOPS-OPERATION OF IN-PILE LOOP L-2-10. F. J. Walter. June 13, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph); $2.40(mf OTS).

The installation, operation, removal, and general performance of the HRP in-pile solution corrosion loop in the HB-2 beam hole at the LITR are described. (W.L.H.)

9290 KAPL-M-ABR-2

Knolls Atomic Power Lab., Schenectady, N. Y.

CORROSION BEHAVIOR OF ALUMINUM ALLOYS IN HIGH TEMPERATURE, PRESSURIZED WATER. Alan B. Riedinger. Mar. 20, 1957. 31p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Available data on the corrosion behavior of Al alloys in high temperature, pressurized water are summarized. The alloys most promising for use above 200°C are M 400, M 388, and X 2219. The corrosion rate of these alloys increases with increasing test temperature, increasing velocity, and increasing pH. Phosphoric acid and the polyhyroxyanthraquinone compounds act as inhibitors. (auth)

GEOLOGY AND MINERALOGY

9291

URANIUM AND THORIUM IN THE ACCESSORY ALLANITE OF IGNEOUS ROCKS. William Lee Smith, Mona L. Franck, and Alexander M. Sherwood (U. S. Geological Survey, Washington). Am. Mineralogist 42, 367-78(1957) May–June.

Accessory allanite was separated from phanerocrystalline igneous rocks and its optical properties and radioactive components were compared. The indices of refraction of these allanite samples are higher than those from the pegmatites that are usually described in geologic literature. The birefringence was found to range from 0.015 to 0.021, the α-index of refraction from 1.690 to 1.775. The allanite content ranges from 0.005 to 0.25% by weight in the rocks studied. The mineral is confined largely to the more sili-

ceous phanerites. The U content is highest in the allanite from the granites sampled, ranging from 0.004 to 0.066%, whereas the Th content is high or low regionally, ranging from 0.35 to 2.33%. Allanite was found to be otherwise of exceptionally uniform composition. (auth)

9292

PRELIMINARY GEOLOGIC MAP OF THE WEST-CENTRAL PART OF THE MINNEKAHTA QUADRANGLE, FALL RIVER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 67. V. R. Wilmarth and R. D. Smith. Washington, U. S. Geological Survey, 1957. $0.50.

9293

PRELIMINARY GEOLOGIC MAP OF THE EAST-CENTRAL PART OF THE MINNEKAHTA QUADRANGLE, FALL RIVER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 68. V. R. Wilmarth and R. D. Smith. Washington, U. S. Geological Survey, 1957. $0.50.

9294

PRELIMINARY GEOLOGIC MAP OF THE SOUTHEAST PART OF THE MINNEKAHTA QUADRANGLE, FALL RIVER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 69. V. R. Wilmarth and R. D. Smith. Washington, U. S. Geological Survey, 1957. $0.50.

9295

PRELIMINARY GEOLOGIC MAP OF THE SOUTHWEST PART OF THE MINNEKAHTA QUADRANGLE, FALL RIVER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 70. V. R. Wilmarth and R. D. Smith. Washington, U. S. Geological Survey, 1957. $0.50.

9296

PRELIMINARY GEOLOGIC MAP OF THE PUMPKIN BUTTES AREA, CAMPBELL AND JOHNSON COUNTIES, WYOMING, SHOWING LOCATION OF URANIUM OCCURRENCES. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 98. W. N. Sharp and A. M. White. Washington, U. S. Geological Survey, 1957. $1.00.

9297

PRELIMINARY GEOLOGIC MAP OF THE LOA 1 NE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 100. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9298

PRELIMINARY GEOLOGIC MAP OF THE LOA 1 SE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 101. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9299

PRELIMINARY GEOLOGIC MAP OF THE LOA 4 NE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 102. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9300

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 1 SW QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 103. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9301

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 2 NE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 104. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9302

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 2 NW QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 105. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9303

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 2 SW QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 106. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9304

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 2 SE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 107. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9305

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 3 NE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 108. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9306

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 3 NW QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 109. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9307

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 3 SW QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 110. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9308

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 3 SE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 111. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9309

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 4 NE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 112. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9310

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 4 NW QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 113. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9311

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 4 SW QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 114. J. F. Smith, Jr., L. C. Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50.

9312

PRELIMINARY GEOLOGIC MAP OF THE NOTOM 4 SE QUADRANGLE, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 115. J. F. Smith, Jr., L. C.

Huff, E. N. Hinrichs, and R. G. Luedke. Washington, U. S. Geological Survey, 1957. $0.50

9313

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-5 QUADRANGLE SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-240. G. E. Tolbert. Washington, U. S. Geological Survey, 1957. $0.50.

9314

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-12 QUADRANGLE SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-241. G. E. Tolbert. Washington, U. S. Geological Survey, 1957. $0.50.

9315

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-13 QUADRANGLE SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-242. G. E. Tolbert. Washington, U. S. Geological Survey, 1957. $0.50.

9316

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-3 QUADRANGLE, EMERY AND CARBON COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-246. C. H. Marshall. Washington, U. S. Geological Survey, 1957. $0.50.

9317

PHOTOGEOLOGIC MAP OF THE FREDONIA NE QUADRANGLE COCONINO AND MOHAVE COUNTIES, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-247. R. H. Morris. Washington, U. S. Geological Survey, 1957. $0.50.

9318

PHOTOGEOLOGIC MAP OF THE JOHNSON SE QUADRANGLE, KANE COUNTY, UTAH, AND COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-248. J. S. Detterman and R. J. Hackman. Washington, U. S. Geological Survey, 1957. $0.50.

9319

PHOTOGEOLOGIC MAP OF THE BUCKSKIN GULCH NW QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-251. R. J. Hackman. Washington, U. S. Geological Survey, 1957. $0.50.

9320

PHOTOGEOLOGIC MAP OF THE HURRICANE CLIFFS-2 NE QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-252. C. H. Marshall. Washington, U. S. Geological Survey, 1957. $0.50.

9321

PHOTOGEOLOGIC MAP OF THE HOUSE ROCK SPRING NW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-253. J. P. Minard. Washington, U. S. Geological Survey, 1957. $0.50.

METALS AND METALLURGY

9322 AERE-M/M-46

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A CONSIDERATION OF THE REQUIREMENTS FOR THE METALLOGRAPHIC EXAMINATION OF SPECIMENS OF UP TO 10 CURIES ACTIVITY. B. W. Mott and S. J. Lloyd. [1951]. Decl Mar. 14, 1957. 12p.

A critical discussion is given of the techniques involved in the metallographic examination of highly active materials. Suggestions are made as to possible ways of overcoming some of the difficulties which may arise, and brief descriptions of suitable equipment are given. It is suggested that the use of the flying spot microscope may be more convenient than conventional microscopy, and some notes on this technique are included in an appendix. (auth)

9323 ANL-5661

Argonne National Lab., Lemont, Ill.

SELECTED PROPERTIES OF VANADIUM ALLOYS FOR REACTOR APPLICATION. K. F. Smith and R. J. Van Thyne. May 1957. 33p. Contract W-31-109-eng-38. $0.30(OTS).

Selected V-base alloys have been investigated as to tensile and creep strength, corrosion resistance, and thermal conductivity at elevated temperatures for the purpose of making a preliminary evaluation of suitability for use as fuel-element jacketing materials for Na-cooled reactors. Results indicate that preliminary feasibility of these alloys from all viewpoints under examination and suggest the desirability of studying fabrication problems of alloys and improved reduction methods for V metal. (auth)

9324 HW-49697

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DIFFUSION OF URANIUM AND ALUMINUM–SILICON EUTECTIC ALLOY. D. R. Green. Apr. 15, 1957. 51p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

The maximum rates of U/AlSi diffusion at temperatures of 200, 250, and 300°C were determined. Maximum overall penetration, x, is approximately related to the time, t, and the absolute temperature, T, by the equation, $x = (K_0 e^{-Q/RT} t)^{1/2} = (K_2 t)^{1/2}$, where K_0 is a constant, Q the activation energy (assumed constant over the small temperature range involved), and R the gas constant. The values of K_0 and Q are 9.7×10^{10} mils^2/hr and 3.15×10^4 cal/mole respectively, for the diffusion of U into AlSi, and 6.75×10^9 mils^2/hr and 2.97×10^4 cal/mole, respectively, for the diffusion of AlSi into U. A small number of thermal cycles between annealing temperature and room temperature during the anneal decreased the final value of K_2. Variations in Si content of the AlSi between 11 and 14% had no measurable effect on the value of K_2, possibly because of masking by other variables. Grain boundary diffusion rates were higher than in immediately adjacent metal in some instances, but no general correlation of maximum penetration with visible grain boundaries existed. UAl_3 was the major phase identified in the diffusion layer. Another phase was found by microhardness methods, but could not be identified. (auth)

9325 ISC-837

Ames Lab., Ames, Iowa.

HANFORD SLUG PROGRAM SEMI-ANNUAL SUMMARY RESEARCH REPORT [FOR] JULY–DECEMBER 1956. 19p Contract W-7405-eng-82. $3.30(ph OTS); $2.40(mf OTS).

Allotropic transformations in U were studied by employing x-ray, resistivity, and sonic techniques. Lattice parameters of U as a function of temperature, crystallography, and orientation relationship and transformation characteristics and kinetics were investigated. Work on the phase boundaries was continued. Thermal diffusivity and electric resistivity of high-purity Fe and mechanical properties of materials are reported. (For preceding period see ISC-837.) (J.E.D.)

9326 KAPL-1746

Knolls Atomic Power Lab., Schenectady, N. Y.

MAGNESIUM–ZIRCONIUM DIFFUSION STUDIES. L. S.

DeLuca, H. T. Sumsion, and D. D. Van Horn. Apr. 1, 1957. 28p. Contract W-31-109-Eng-52. $0.25(OTS).

The interdiffusion rates between Mg and Zr were determined by metallographic methods for the temperature range of 500 to 640°C. The diffusion of Mg into Zr embrittled the Zr but did not change the appearance of its microstructure. The diffusion of Zr into Mg produced at least two distinct zones, both of which may be part of a single phase. (auth)

9327 KAPL-M-AME-4

Knolls Atomic Power Lab., Schenectady, N. Y.

WELDING OF CANS FOR TITANIUM EXTRUSIONS. Edward F. Bulson. Jan. 22, 1957. 15p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The welding of Ti triflutes, cruciforms, and rectangular containers of various thicknesses and sizes for extrusion purposes is described. The inert arc method was used in a dry box with automatically controlled arc voltage. (T.R.H.)

9328 KAPL-M-DBK-3

Knolls Atomic Power Lab., Schenectady, N. Y.

EVALUATION OF DISSIMILAR-METAL WELDS BETWEEN TIMKEN 16-25-6 AND TYPES 304 AND 347 STAINLESS STEEL. D. B. Kittle. Apr. 24, 1957. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The weldability and mechanical properties of welds between Timken 16-25-6 (Ni–Cr–Mo) steel and types 304 and 347 stainless steel were studied. Welds of good quality were obtained by all three methods used: direct fusion; using 29-9 and 308 filler material; and overlaying the 16-25-6 with 29-9 and fusing to the overlay. Filler metal (29-9 or 308) should be used in welding 304 to 16-25-6. The use of filler metal gave greater ductility than direct fusion. (T.R.H.)

9329 LA-1660

Los Alamos Scientific Lab., N. Mex.

THE PREPARATION OF HYDRIDES OF MAGNESIUM AND BERYLLIUM. Charles E. Holley, Jr. and Joe F. Lemons. Apr. 1, 1954. Decl. Jan. 28, 1955. 72p. Contract W-7405-eng-36. $12.30(ph OTS); $4.50(mf OTS).

9330 NAA-SR-1867

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EFFECT OF SODIUM ON THE MECHANICAL PROPERTIES OF ZIRCONIUM. J. C. Bokros. June 15, 1957. 39p. Contract AT-11-1-GEN-8. $0.30(OTS).

Zirconium is useful as a structural material in nuclear reactors, and is employed in contact with high temperature liquid Na. It was found that surface oxide which develops on Zr in Na significantly lowers the fatigue life at elevated temperatures. Hydrogen on the other hand has very little effect on the fatigue life at elevated temperatures but lowers the fatigue life at room temperature. It was also found that exaggerated grain growth which occurs above 950°F in Zr severely reduces the fatigue life at elevated as well as low temperatures. The effect of Na, i.e., the pick-up of surface oxide and reasonable amounts of H_2, does not significantly alter the tensile properties of Zr at high temperature. Data also indicate that Zr is stable to dimensional changes after thermal cycling. (auth)

9331 NAA-SR-1926

North American Aviation Inc., Downey, Calif.

GERMINATIVE GRAIN GROWTH CHARACTERISTICS OF ZIRCONIUM. J. C. Bokros. June 15, 1957. 26p. Contract AT(11-1)-GEN-8. $0.25(OTS).

Zirconium, because of its low neutron capture cross section, is potentially an important structural material for use in nuclear reactors. At temperatures above 950°F, Zr which has been strained a critical amount will experience germinative grain growth during recrystallization. This grain growth can result in a reduction in the fatigue life by a factor of 2 to a factor of 9 at both high and low temperatures. The critical strains for Zr vary from 15% at 900°F to about 2% at 1125°F, while those for zircaloy III vary from 15% at 1050°F to 5% at 1200°F. A study was made of the variation of recrystallized grain size versus plastic strain and annealing temperature. This showed that in order to avoid germinative grain growth, a temperature limitation must be placed on inhomogeneously deformed Zr and zircaloy III. The limitations are between 900 and 950°F for Zr and 1050°F for zircaloy III. Zircaloy II experiences no germinative grain growth up to 1200°F. (auth)

9332 NMI-1176

Nuclear Metals, Inc., Cambridge, Mass.

QUARTERLY PROGRESS REPORT FOR THE PERIOD JANUARY 1, 1957 THROUGH MARCH 31, 1957. May 20, 1957. 25p. Contract AT(30-1)-1565.

Irradiation thimbles were Ir-plated, the assembly arrangements were completed, and most of the assembled capsules were evacuated and sealed for irradiation to start. Studies of Tandem-Extrusion of Pb–Sb alloys are continuing. The solubility of metals in several metal solvents is being evaluated and an attempt is being made to relate them to a set of solubility parameters. Work is continuing on the effects of radiation damage on a precipitation-hardening Cu–Fe alloy. The effect of other elements on the fracture tendency on (1120) planes in Be is discussed. (W.L.H.)

9333

ELECTRON MICROSCOPE AND DIFFRACTION STUDIES OF 7% CHROMIUM–MOLYBDENUM STEELS. Betty E. Williams (National Physical Lab., Teddington, Middlesex). Brit. J. Appl. Phys. 8, 241-7(1957) June.

An investigation into the structural properties of some 7% Cr–Mo creep-resisting steels was carried out using electron microscopy and diffraction. The presence of fine precipitate of TiC in good creep steels is observed. (auth)

9334

HYDROGEN ABSORPTION, EMBRITTLEMENT AND FRACTURE OF STEEL. Arnold E. Schuetz (Shell Development Co., Emeryville, Calif.) and W. D. Robertson (Bridgeport Brass Co., Conn.). Corrosion 13, 437t-58t (1957) July.

After a review of the problems associated with spontaneous fracture of steels in sour gas condensate wells an account of the investigation is given. Hydrogen sulfide embrittlement was compared with that caused by cathodic charging. An investigation was made of spontaneous fracture under conditions of constant deformation, as dependent on alloy composition, heat treatment, plastic deformation and chemical environment. Hydrogen absorption by iron-nickel alloys from hydrogen sulfide was compared to that from sulfuric acid. Permeation rate of hydrogen through austenitic, martensitic and ferritic states of iron-nickel alloys was measured. Time dependence of static fracture of iron-nickel alloys as a function of applied stress, structure and hydrogen concentration was evaluated. The following conclusions are given: Basic cause of failure is absorption of hydrogen. Principal factors in service failure are internal stress, magnitude of applied stress and hydrogen content. Both martensitic and ferritic structures fail when the stress level and hydrogen content are sufficiently high. Trace amounts of carbon, oxygen and nitrogen in 10 percent nickel steel have no detectable effect on failure. Adoption of limiting strength or hardness below which fracture does not occur in constant

deformation tests is unreliable in predicting service life. Because it is impractical to lower operating stress significantly below apparent "endurance limit" the remaining alternative is reduction of hydrogen concentration in the steel. Deadload tests in the environment must be made before safe operating procedures can be defined. (auth)

9335

PHASE TRANSITIONS IN CHROMIUM-BASE Cr–Mo–Fe ALLOYS. N. V. Ageev, L. N. Guseva, and K. P. Markovich. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 4, 23-32(1957) Apr. (In Russian)

Kinetics of phase transitions in solid solutions of chromium-base alloys with 15 to 25 wt.% of Mo and Fe were studied in the temperature range of 1050 to 750°C. Effects of various alloying materials (C, Ti, Al, and Si) on the phase transition processes in the alloy were evaluated. (R.V.J.)

9336

EFFECTS OF COMPLEX ALLOYING ON THE WEAR RESISTANCE OF STRUCTURAL STEEL. M. P. Brown. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 4, 148-51(1957) Apr. (In Russian)

9337

OXIDATION OF IRON–NICKEL ALLOYS. II. ELECTRON DIFFRACTION AT HIGH TEMPERATURE. R. T. Foley, C. J. Guare, and H. R. Schmidt (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 104, 413-17 (1957) July.

The oxidation of Fe–Ni alloys of 30, 41, and 78 Ni content has been studied at temperatures of 600, 700, 800, and 900°C by the electron diffraction technique. A special furnace was developed for the electron diffraction instrument for these experiments. Usually more than one oxide was present on the alloy at these elevated temperatures. Unlike the conclusion drawn from exclusively room temperature observations, the predominant oxide on the 30 and 41% Ni alloys was the ferrite (Fe_3O_4 or $NiFe_2O_4$) rather than alpha-Fe_2O_3. At 700 and 900° both NiO and MoO_3 exist on the 78% alloy. (This alloy contains 3.8% Mo.) The presence of MoO_3 above its melting point and where it exerts considerable vapor pressure is difficult to explain. In some cases the lattice spacings of the alloy structure are carried over into the first formed oxide film. With subsequent growth the spacings achieve the normal (x-ray) values for the oxide. (auth)

9338

THE ACTIVATION AND PASSIVATION OF STAINLESS STEEL IN AERATED SULFURIC ACID. G. H. Cartledge (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 104, 420-6(1957) July.

Potential-time curves have been determined at 85°C for a Nb-stabilized stainless steel during its transition to the state that is essentially stable in aerated 0.1N sulfuric acid. Experiments were conducted both with pre-oxidized specimens and with others that were previously saturated with H_2 by electrolysis. It was found that the potential passes through characteristic inflections, and an attempt was made to relate these to the processes with which they are associated. In particular, it was found that, for the conditions used, there is a "critical recovery potential" above which spontaneous passivation occurs, and this potential was shown to be approximately equal to the hydrogen potential for the same conditions. The corrosion rate was shown to be characteristically related to the changes in potential. (auth)

9339

HIGH TEMPERATURE OXIDATION OF HIGH PURITY NICKEL BETWEEN 750° AND 1050°C. Earl A. Gulbransen and Kenneth F. Andrew (Westinghouse Electric Corp., Pittsburgh). J. Electrochem. Soc. 104, 451-4(1957) July.

Kinetic studies on the oxidation of Ni using the vacuum microbalance method have been extended to 1050°C in order to determine the conditions and mechanisms of breakdown of the metal in oxidation. Below 900°C Ni oxidizes in the normal manner and the rate data fit in well with experimental rate relationship already established. At 900°C and higher, parabolic rate law plots of the data show increasing values of the constant with time. At 1000°C and higher, the oxide cracks away from the metal. It is suggested that Ni fails in protective oxidation due to a loss of adhesion at the oxide metal interface. (auth)

9340

SOLID-SOLUTION HARDENING OF ALUMINIUM AND MAGNESIUM. D. Hardie (U. K. Atomic Energy Authority, nr. Warrington, Lancs.) and R. N. Parkins (King's Coll., Newcastle-upon-Tyne). J. Inst. Metals 85, 449-55(1957) June.

A linear relation between concentration and extent of hardening has been observed for various solutes dissolved in aluminum and magnesium. A relationship also exists between hardening and the distortion introduced into the lattice by the solute; with certain exceptions, this relationship takes a linear form with aluminum and a quadratic form with magnesium. (auth)

9341

ARC WELDING OF VACUUM- AND INERT-ATMOSPHERE-MELTED ZIRCALOY-2. Howard C. Ludwig (Westinghouse Electric Corp., Pittsburgh). Welding J. (N. Y.) 36, 335-s-41-s(1957) July.

The differences found in penetration when arc welding zirconium sponge-base alloys, melted by two melting processes, have been attributed to a variance in anode heat output as determined from calorimetric measurements. Indications are that the variance in anode heat output is due to the diffusion and evaporation of chlorine and hydrogen from the arc-melted anode surface. These gases are present in the zirconium alloys as residuals whose source is the zirconium sponge. A mechanism by which the gases increase the anode heat output is described. (auth)

9342

MOLYBDENUM. L. Northcott. New York, Academic Press Inc., 1956. 234p.

The history, extraction, physical properties, mechanical properties, powder metallurgy, oxidation, and protection of Mo and its alloys are discussed at length in this volume. (W.L.H.)

PHYSICS

9343 MURA-311

Midwestern Universities Research Assn., Madison, Wis. PROPERTIES OF NEUTRALIZED RELATIVISTIC ELECTRON BEAMS. J. Enoch. June 1957. 16p. Contract AT(11-1)-384. $3.30(ph OTS); $2.40(mf OTS).

The equilibrium properties of an intense, radiation-pinched, electron beam, which is neutralized by positive ions in the laboratory system, are studied. The motion of a test electron in such a beam is treated statistically, taking into account radiation damping and collisions with positive ions. By requiring that the calculated distribution of electrons as a function of distance from the center of the beam be equal to the distribution assumed in writing down the equations of motion, an expression for the equilibrium current is obtained. An expression for the

equilibrium minor radius of the beam in terms of the acceleration per turn available is also obtained. An apparent discrepancy between the value of the equilibrium current as obtained in the present report and the value given by Budker (Proceedings of the CERN Symposium 1956, p. 68) is explained in terms of assumptions about the energy distribution of the electrons; (auth)

9344 RM-1844(RAND)

RAND Corp., Santa Monica, Calif.

A RECOVERABLE SCIENTIFIC SATELLITE. Carl Gazley, Jr. and David J. Masson. Dec. 21, 1956. 31p. (AD-112406).

The uncontrolled descent of a satellite from its orbit involves a less severe heating problem than the re-entry of a long-range ballistic missile because of the more gradual descent and consequent smaller deceleration of the satellite. The satellite descent is slow enough so that the thin skin attains the radiation equilibrium temperature corresponding to a given velocity and altitude. Although the shallow descent alleviates the heating problem somewhat, the location of the impact point is complicated by the nature of the descent. The location of the impact point appears to be the most difficult aspect of a recovery program, but can be accomplished by radio tracking and ultimate recovery by means of a radio beacon. (auth)

9345 WADC-TR-54-409(Pt. II)

Oklahoma Agricultural and Mechanical Coll., Stillwater. School of Electrical Engineering.

UNCONVENTIONAL ELECTRICAL POWER SOURCES. Paul A. McCollum. Sept. 1955. 74p. Project title: ELECTRICAL GENERATION EQUIPMENT. Task title: STUDY AND RESEARCH PROGRAM ON UNCONVENTIONAL ELECTRICAL POWER SUPPLIES. Contract AF33(616)-2237. (AD-93862).

Research directed toward gaining additional information concerning the theoretical and practical limitations and capabilities of generating electrical power by means other than rotating mechinery, conventional batteries, or radioactive devices is described. Data and theory are presented on Oscillating Electromagnetic Induction, the Thermocouple, the Ion Exchange Membrane, the Fuel Cell, and the Solar Battery. Results of laboratory experimentation are presented on Oscillating Electromagnetic Induction, the Thermocouple, and the Ion Exchange Membrane. Objectives of the study and experimentation included the determination of efficiency of energy conversion, weight and size per unit power output, range of voltage and current, life and reliability. (auth)

9346

APPROACH TO EQUILIBRIUM IONIZATION BEHIND STRONG SHOCK WAVES IN ARGON. Harry Petschek and Stanley Byron (Cornell Univ., Ithaca, N. Y.). Annals of Physics 1, 270-315(1957) June.

Previous work on strong shock waves in argon has shown that the degree of ionization reaches thermodynamic equilibrium for shock speeds greater than about ten times the speed of sound in room temperature A. The degree of ionization reaches about 25% at the highest shock strengths available in an ordinary shock tube. This paper reports a detailed theoretical and experimental study of the approach of high-temperature A to this equilibrium degree of ionization. The mechanism for the approach to equilibrium can be divided into two stages. The first, which accounts for about 10% of the final ionization, is apparently controlled by impurities present in the gas even after considerable care is taken to insure high purity. No reasonable explanation has been found for the unusual effectiveness of impurities in ionizing A. In the second stage, ionization by electron-atom collisions becomes dominant. The rate of ionization by this process is limited by the rate of energy transfer to electrons by elastic collisions with the atoms and ions in the gas and is relatively independent of the inelastic ionization cross section. This rate is calculated and is in agreement with experimental measurements making use of the visible continuum radiation from the gas, and the electrostatic potentials in the gas due to the diffusion of electrons. (auth)

9347

ON THE DEPTH OF MODERATE ENERGY ION PENETRATION INTO MATTER. M. M. Bredov and N. M. Okuneva. (Inst. of Semiconductors, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 795-6(1957) Apr. 1. (In Russian)

Measurements were made of the 4-kev Cs ion penetration into Ge. The radioactive isotopes Cs^{134} with 2.2 year half life was added to common Cs to determine the depth of penetration. The activity of irradiated samples was measured after dipping into the standard solutions of hydrogen peroxide. It was found that Cs ions with energy 4 kev penetrated into Ge on the order of 0.1 μ. (R.V.J.)

9348

SHOCK HUGONIOT OF AIR. W. E. Deal (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 28, 782-4(1957) July.

Experiments are described in which an explosive-driven plate sets up a strong shock in air in contact with the plate. Plate velocity and air shock velocity are measured by means of a high-speed framing camera. A pressure-compression relation results from these measurements through use of the conservation equations of hydrodynamics. The experimental results up to pressures of 200 bars are comared to a calculated relation. (auth)

9349

ENERGY TRANSPORT BY CASCADE AND RESONANCE PROCESSES IN DOUBLY ACTIVATED PHOSPHORS. Esther W. Claffy and Clifford C. Klick (U. S. Naval Research Lab., Washington). J. Electrochem. Soc. 104, 445-7(1957) July.

A method, using quantum efficiency measurements, is described for obtaining the efficiency of energy transfer from sensitizer to activator centers in doubly activated phosphors when both centers have allowed transitions. From these measurements and applying the theory of resonant transfer it is concluded that, for NaCl: Ag, Cu, both cascade and resonant transfer mechanisms are important and that the resonant transfer process increases more rapidly with concentration than does the cascade process. (auth)

9350

THE INTERACTIONS OF WAVES AND ELECTRONS AND REMARKS ON SUPERCONDUCTIVITY. L. Brillouin. J. phys. radium 18, 331-6(1957) May. (In French)

9351

MAGNETIC SUSCEPTIBILITY OF IRON–NICKEL ALLOYS IN LIQUID AND SOLID STATES. Yasuaki Nakagawa (Univ. of Tokyo). J. Phys. Soc. Japan 12, 700-7(1957) June.

The magnetic susceptibilities of various Fe–Ni alloys have been measured through their melting points up to 1600°C. The susceptibilities of the alloys with less than 60% Ni increase discontinuously on melting, while those of the alloys with more than 60% Ni decrease. The temperature variation of the susceptibilities is approximately expressed by the Curie-Weiss law in the liquid state as well as in the solid state, but the Curie constants and the paramagnetic Curie temperatures of liquids are in general different from those of solids. These results can be explained by assuming that the atomic magnetic moments remain unaltered and that the magnetic interaction varies with the

interatomic distance as indicated by the Bethe-Slater curve. The change of susceptibility at the melting point is solely due to the difference in interatomic distance between the liquid and the solid. It is expected, in some cases, that the especially strong dependence of the magnetic interaction on the interatomic distance results in an appreciable change of interaction with temperature through the thermal expansion. It can account for the anomalously large Curie constants of pure γ-Fe and Fe-rich alloys in the solid state. (auth)

9352

MAGNETIC ANNEALING EFFECT IN IRON–NICKEL FERRITES. Yoshimichi Aiyama, Hisashi Sekizawa, and Shûichi Iida (Tokyo Univ.). J. Phys. Soc. Japan 12, 742-3 (1957) June.

It was shown that the magnitude of the uniaxial anisotropy of Fe–Ni ferrites depends essentially on the degree of oxidation of the specimen. The magnetic annealing is ineffective in nickel-rich specimens, however, due perhaps to the insufficiency of the vacancy concentration. (M.H.R.)

9353

STUDIES OF THE UPPER REGIONS OF THE ATMOSPHERE. V. I. Krasovskii (Moscow Inst. of Atmosphere Physics). Priroda 46, No. 5, 55-60(1957) May. (In Russian)

An outline is given of studies programmed by the Inst. of Atmosphere Physics for their three new stations located at 68°38′ latitude 33°20′ longitude; 60°12′ latitude 29°34′ longitude; and, 55°42′ latitude 36°44′ long. The stations are equipped with spectrographic and radiolocating apparatus for the studies of atmospheric emissions. (R.V.J.)

9354

PROPAGATION OF ELECTRIC WAVES IN PLASMA (IONOSPHERE). B. N. Gershman, V. L. Ginzburg, and N. G. Denisov. Uspekhi Fiz. Nauk 61, 561-612(1957) Apr. (In Russian)

A review is given of the new data on the theory of wave propagation in plasma. Electromagnetic wave propagation in homogeneous magnetoactive plasma and propagation of normal waves in magnetoactive plasma considering the thermal motion of electrons and motion of ions are discussed. The properties of an electromagnetic wave field expanding in heterogeneous isotopic plasma, the plasmic wave effects on the field behavior, and its behavior in magnetoactive heterogeneous plasma are described. References are made to the interaction of common and unusual waves in ionosphere (effects of reflected radiosignal "multiplications"), wave interactions considering absorption, and finite polarization of waves discharging from the ionosphere. (R.V.J.)

COSMIC RADIATION

9355

THEORY OF HIGH-ENERGY N-COMPONENT CASCADES. Stanislaw Olbert and Raymond Stora (Massachusetts Inst. of Tech., Cambridge). Annals of Physics 1, 247-69(1957) June.

The longitudinal development of the N component of cosmic rays is studied theoretically in the extreme relativistic region. The integro-differential equations of the N-component cascades are solved analytically for kernel functions which describe multiple meson production in nucleon-nucleon collisions. It is shown that Fermi's and Landau's models are included in the general solutions as two special cases. Some numerical examples for initial conditions of interest are quoted to demonstrate the mathematical procedures involved. In conclusion, a generalization of the discussed kernel functions is proposed in order to incorporate a possible partial elasticity in high-energy nucleon-nucleon collisions. (auth)

9356

THE ANGULAR AND LATERAL DISTRIBUTION FUNCTION OF PARTICLES IN THE CASCADE SHOWER MAXIMUM. V. V. Guzhavin and I. P. Ivanenko (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 113, 533-6(1957) Mar. 21. (In Russian)

The method of moments was used in compilations of the angular and spatial distribution function. The analysis of the equations derived showed dependence of functions on $\bar{r}$ and $\bar{\theta}$ only in combination of $x_\theta = E_\theta/E_s$ ($x_r = E_r/E_s$), where $E_s = 31$ Mev and the angular distribution differential function $P(E_0, E, t) = P_{lat}(E_0, E, t)\, P(s, x_\theta)$. Results of computations of functions $P(l, x_\theta)$ and $P(l, x_r)$ are given in tabular form. (R.V.J.)

9357

CROSS-SECTION MEASUREMENT NEAR 50 Bev. A. E. Brenner and Robert W. Williams (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 1020-5(1957) June 1.

An experiment to measure the cross section for high-energy cosmic-ray protons and neutrons to interact with the Fe nucleus has been carried out at 3250 m elevation. The detector had a relatively good energy resolution, and was designed to select nucleons in the vicinity of 50 Bev. The purpose was to obtain a single interaction cross section with good accuracy in order to compare it with results obtained with accelerators in the 1- to 5-Bev region. This comparison yields a value for the elementary meson-production cross section [the average of σ(pp) and σ(np)] near 50 Bev. The Fe results are: neutrons, $\sigma_{Fe} = 0.61 \pm 0.03$ b; protons, $\sigma_{Fe} = 0.61 \pm 0.04$ b. The corresponding average nucleon-nucleon "inelastic" (presumably meson production) cross section is $\sigma_{nucleon} = 21 \pm 4$ mb. (auth)

9358

NUCLEAR INTERACTIONS OF COSMIC RAYS IN ALUMINUM. W. W. Brown (Univ. of California, Berkeley). Phys. Rev. 106, 1025-6(1957) June 1.

A method is described in which cosmic-ray nuclear interactions occurring in thin Al foils and A gas within a cloud chamber can be detected and the tracks of the emitted charged particles observed. The observed ratio of the number of nuclear interactions per atom of A to that of Al is 1.4 ± 0.2, in agreement with the ratio of the nuclear areas of these atoms, 1.3. (auth)

9359

SPECTRUM OF LOW-RIGIDITY COSMIC RAYS DURING THE SOLAR FLARE OF FEBRUARY 23, 1956. J. A. Van Allen (State Univ. of Iowa, Iowa City) and J. R. Winckler (Univ. of Minnesota, Minneapolis). Phys. Rev. 106, 1072-3 (1957) June 1.

By combining previously reported high-altitude total intensity data from balloon flights at Minneapolis and Iowa City it was found that the magnetic rigidity spectrum of solar flare particles at 2100 G.M.T. on February 23, 1956 (17 hours after onset of the event) was steeply rising toward low rigidities as about R^{-5} for rigidities R of about 1.2 Bv. The flare data at high altitude and high latitude are compared with low-altitude neutron monitor data. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

9360

INVESTIGATIONS OF THE CRYSTALLINE STRUCTURE OF RUBIDIUM HALIDE AT HIGH PRESSURE. L. F. Vereshchagin and S. S. Kabalkina (Physics Lab. of Super-

high Pressures, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 797-8(1957) Apr. 1. (In Russian)

It is shown that the crystalline structure of RbI and RbCl under 11,000 and 7500 kg/cm^2 pressure at room temperature is of CsCl type with the constant α lattice of 3.82 A for RbCl and 4.29 A for RbI. (R.V.J.)

9361

EXHAUSTION BARRIERS IN ZINC SULPHIDE. G. F. Alfrey and K. N. R. Taylor (Birmingham Univ.). Helv. Phys. Acta 30, No. 2-3, 206-8(1957).

The nature of the exhaustion barrier at a metallic contact to a ZnS crystal is considered in the light of the evidence of electroluminescence and of the effect of electric fields on the scintillations produced by alpha particles. The evidence suggests that the donor states whose depletion gives rise to the barrier are concentrated at a single energy level, rather than distributed through the forbidden band. (auth)

9362

STRUCTURAL INVESTIGATION BY MEANS OF NUCLEAR QUADRUPOLE RESONANCE. I. DETERMINATION OF CRYSTAL SYMMETRY. Kenji Shimomura (Hiroshima Univ.). J. Phys. Soc. Japan 12, 652-7(1957) June.

The number of nonequivalent directions of the z axes of the field gradient in the crystal for every symmetry class is calculated. It is shown that the symmetry of the crystal may be discussed and the orientations of nonequivalent directions may be determined with respect to the axes of symmetry through the Zeeman analysis of nuclear quadrupole resonance line. (auth)

9363

STRUCTURAL INVESTIGATION BY MEANS OF NUCLEAR QUADRUPOLE RESONANCE. II. TIN TETRABROMIDE. Kenji Shimomura (Hiroshima Univ.). J. Phys. Soc. Japan 12, 657-67(1957) June.

Details of the universal quadrupole resonance crystal analyzer were described, and using this apparatus the crystal structure of SnBr was studied at room temperature (15 to 20°C). The $SnBr_4$ molecule is an almost exact tetrahedron, and each of the four resonance lines is assigned to each Br atom situated at the apexes of the tetrahedron, and the value of asymmetry parameter of the field gradient at the Br nucleus is less than 0.025. The crystal has monoclinic symmetry and one of the Sn-Br bond in one molecule is perpendicular to the b axis and the other two orient at the same angle to the b axis. All atoms including Sn in a molecule have nonequivalent general positions in the crystal, and the number of molecules in a unit-cell is equal to the maximum number of equivalent coordinates of the space-group. The existence of pair of two molecules is suggested, and the origin of the splitting of the spectrum is discussed. $SnBr_4$ may be assigned to the symmetry class C_{2h}. The crystal symmetry of the low temperature phase is assigned to the cubic or hexagonal class. (auth)

ELECTRICAL DISCHARGE

9364 UCRL-4830

California. Univ., Livermore. Radiation Lab. REFLEX DISCHARGES IN HYDROGEN. Edmund S. Chambers. Feb. 26, 1957. 20p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Electrical discharges in a magnetic field were studied experimentally. Hydrogen, at pressures between 1 and 10 μ of Hg, was used. A hot W cathode was employed with a discharge potential up to 320 v. With a simple anode only, a discharge current of about 30 ma was obtained. However, with a reflecting cathode in reflex geometry, currents of tens of amperes flowed. The d-c current was accompanied by a large r-f hash component, particularly in the reflex case. Usually this was incoherent, but there were several experiments where a definite sine wave was observed and measured. Experimental results are interpreted in terms of known facts. A partially developed theory on the mechanism of the discharge is presented. (auth)

9365

DETERMINATION OF THE COEFFICIENT OF DIFFUSION AND FREQUENCY OF IONIZATION IN MICROWAVE DISCHARGES. M. P. Madan, E. I. Gordon, S. J. Buchsbaum, and Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 839-43(1957) June 1.

A method is presented for direct determination of the frequency of ionization and of the coefficient of free diffusion for electrons in a microwave discharge. The method is based on determining the rate of growth of the electron density in a microwave cavity in which an electric field larger than that necessary for breakdown is applied. The ionization frequency and the coefficient of free diffusion for electrons in hydrogen were measured in a pressure range of 15 to 45 mm Hg. Comparison is made with existing theory. (auth)

9366

STATISTICAL MECHANICAL THEORY OF TRANSPORT PHENOMENA IN A FULLY IONIZED GAS. Wesley E. Brittin (Univ. of Alaska, Coll.). Phys. Rev. 106, 843-7 (1957) June 1.

Nonequilibrium statistical mechanics, as developed by Kirkwood, Irving, and Zwanzig, is applied to a system of charged particles interacting via the electromagnetic field. Particles and field are treated statistically both from the classical and quantal points of view. It is shown that Maxwell's equations are valid for the quantum statistical ensemble-averaged fields. An exact form for the hydromagnetic equations is derived, and it is shown that these equations differ from those which are customarily considered to be exact. (auth)

9367

PLASMA LOSSES BY FAST ELECTRONS IN THIN FILMS. R. H. Ritchie (Oak Ridge National Lab., Tenn.). Phys. Rev. 106, 874-81(1957) June 1.

The angle-energy distribution of a fast electron losing energy to the conduction electrons in a thick metallic foil has been derived assuming that the conduction electrons constitute a Fermi-Dirac gas and that the fast electron undergoes only small fractional energy and momentum changes. This distribution exhibits both collective interaction characteristics and individual interaction characteristics, and is more general than the result obtained by other workers. Describing the conduction electrons by the hydrodynamical equations of Bloch, it has been shown that for very thin idealized foils energy loss may occur at a value which is less than the plasma energy, while as the foil thickness decreases below $\sim v/\omega_p$ the loss at the plasma energy becomes less than that predicted by more conventional theories. The net result is an increase in the energy loss per unit thickness as the foil thickness is decreased. It is suggested that the predicted loss at subplasma energies may correspond to some of the low-lying energy losses which have been observed by experimenters using thin foils. (auth)

ELECTRONS

9368

ON THE THEORY OF β-INTERACTION. H. Koppe (Univ.

Heidelberg). Nuclear Phys. 3, 585-91(1957) June. (In German)

It is shown that nonconservation of parity in β interaction cannot lead to an electric dipole moment of fermions, if the coupling constants are real; and that a coupling with $(1 + i\gamma_5)$ leads to vanishing magnetic and electric moments of the neutrino. (auth)

9369

NUMERICAL CALCULATIONS OF THE NEW APPROACH TO THE CASCADE THEORY. II. S. K. Srinivasan and N. R. Ranganathan (Univ. of Madras, India). Proc. Indian Acad. Sci. 45, 268-72(1957) Apr.

Numerical results on the mean numbers of electrons produced in small thicknesses in a shower initiated by a single electron are presented on the basis of the new approach to the cascade theory. (auth)

GASES

9370

THE CURRENT STATUS OF W, THE ENERGY TO PRODUCE ONE ION PAIR IN A GAS. Jerome Weiss and W. Bernstein (Brookhaven National Lab., Upton, N. Y.). Radiation Research 6, 603-10(1957) June.

There are several experimental methods for the determination of W, two of these are described in detail. The experimental and theoretical values of W for different gases are listed along with value for α-particles and electrons for various gases. (W.L.H.)

INSTRUMENTS

9371 CISE-54

Centro Informazioni Studi Esperienze, Milan.

ANALYSIS OF A THIRD ORDER RELAY SERVOMECHANISM. F. Dalla Volta and M. Schiavon. Mar. 31, 1957. 35p.

Limitations of conventional methods for the analysis of nonlinear systems when dealing with a relay servo mechanism including two integrating elements are discussed. A chart is given by which the design of the system may be performed with the aid of non-dimensional parameters. (auth)

9372 DP-120

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A SIMPLIFIED ELECTRONIC CIRCUIT FOR ULTRASONIC INSPECTION. J. D. Ross and R. W. Leep. Jan. 1956. 16p. Contract AT(07-2)-1. $3.30(ph OTS); $2.40(mf OTS).

A simplified electronic circuit was developed which utilizes $BaTiO_3$ transducers. The need for a high-voltage pulser and a high-gain amplifier was eliminated. (auth)

9373

SOME ELECTRONIC INSTRUMENTS USED IN NUCLEAR SPECTROSCOPIC INVESTIGATIONS. Björn Aström (Nobel Inst. for Physics, Stockholm, Sweden). Arkiv Fysik 12, No. 3, 215-36(1957).

A description is given of two complete pulse-height spectrometers for electromagnetic radiations and alpha particles respectively. The detectors and the electronic devices used for the counting and analyzing of the detector pulses are described in some detail. (auth)

9374

ON AUTOMATIC CODING IN PROGRAMMING LANGUAGE TRANSLATION PROBLEMS. S. N. Razumovskiĭ. (Inst. of Precision Mechanics and Computation Techniques). Doklady Akad. Nauk S.S.S.R. 113, 760-1(1957) Apr. 1. (In Russian)

9375

COMPENSATION AND DESIGN CRITERIA FOR A RELAY SERVOMECHANISM INCLUDING TWO INTEGRATING ELEMENTS. F. Dalla Volta and M. Schiavon (CISE Labs., Milano). Energia nucleare (Milan) 4, 139-45(1957) Apr.

A relay servomechanism in which the relay drives two integrating elements is discussed. The study is based on some indications furnished by theoretical calculations and carried out of experimental data obtained from an analog computer. It is shown that stability and correctly shaped response are not the only requirements to be met in designing relay servosystems: care must be taken to avoid excessive shocks which might cause overheating or untolerable wear in the equipment. (auth)

ISOTOPES

9376

THE ELEMENT Cf^{254} AND THE LIGHT CURVE OF THE SUPERNOVAE OF THE TYPE I. A CONTRIBUTION TO THE QUESTION OF THE SYNTHESIS OF HEAVY ELEMENTS IN THE COSMOS. Von St. Temesváry. Naturwissenchaften 44, No. 11, 321-3(1957). (In German)

9377

THE PRODUCTION OF In^{113m} FROM NEUTRON BOMBARDED TIN USING METALLO-ORGANIC COMPOUNDS. V. D. Nefedov, G. P. Lepnev, et al. (Zhdanov Leningrad State Univ.) Zhur. Fiz. Khim. 31, 354-61(1957) Feb. (In Russian)

The production of long life carrier-loss In^{113m} using the metallo-organic compounds $Sn(C_6H_5)_4$ and $Sn(C_6H_5)Cl$ as parent substances is described. Pure preparations of In^{113} have been obtained in quantitative yields. (tr-auth)

ISOTOPE SEPARATION

9378 ORNL-2275

Oak Ridge National Lab., Tenn.

RETENTION OF ELECTROMAGNETICALLY SEPARATED INERT-GAS ISOTOPES. H. B. Greene. July 12, 1957. 21p. Contract W-7405-eng-26. $0.25(OTS).

Experimentation has been undertaken to establish that inert-gas ions produced in the electromagnetic separators can be collected and retained on metal surfaces by means of adsorption. A technique has been worked out whereby target surfaces quickly saturated at ordinary reception rates can be renewed by continuous or periodic vaporization and condensation of a suitable metal. Subsequent outgassing of these targets for recovery of the collected isotopes yields many times more gaseous impurities than desired product, and a practical system for cleaning the inert gases to chemical purities of 99.5% or better is described. From one run, lasting about 100 hr, during which 5.3 ma-hr (4.4 ml) of A^{36} was monitored, approximately 2.0 ml of natural A^{36} was recovered. About 1.5 ml of this was enhanced from a natural isotopic abundance of 0.34% to about 70%. From the same run, 118 ml of A^{40} was recovered, most of which assayed better than 99.98%. (auth)

9379

ISOTOPE SEPARATION BY GASEOUS DIFFUSION. II. CONTINUOUS CASCADES. E. Brutto, G. Perona and R. Sesini. Energia nucleare (Milan) 4, 128-30(1957) Apr. (In Italian)

A scheme of continuous cascade for isotopes separation by diffusion in gaseous phase is suggested. Overcoming the ideal cascade concept stated by Cohen, the harmful minglings are removed thus increasing the efficiency. (auth)

MASS SPECTROGRAPHY

9380 IDO-14371(Rev.)
Idaho Operations Office, AEC.
MAGNETIZATION OF CPP MASS SPECTROMETER MAGNET. F. L. Petree. June 17, 1957. 14p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

A pulse method was used to magnetize the surface emission mass spectrometer at the Idaho Chemical Processing Plant, permitting the use of light, inexpensive components in place of heavy welding equipment previously used. A bank of electrolytic capacitors was discharged through twelve parallel-connected coils. After magnetization, the flux in the airgap measured 2000 gauss with the adjustable shunt completely closed. This is an equivalent to a flux in the iron of 9000 gauss or greater. (auth)

9381
A MASS SPECTROMETER WITH IMPROVED PROPERTIES FOR THE ANALYSIS OF HYDROGEN CONTAINING A LOW CONCENTRATION OF DEUTERIUM. Dragutin D. Gvozdanovic. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 83-91(1957) Mar.

A mass spectrometer suitable for the measurement and comparison of isotope ratios of samples of hydrogen gas containing 0.003 mole % D to 1 mole % D is described. An ion source without magnetic field is used, thereby eliminating one factor of mass discrimination. Other factors of mass discrimination are taken into account, and direct measurements are made. Results of these measurements are in good agreement (3%) with results obtained by other methods. Samples containing 0.015 mole % D can be compared with a precision of 0.0001 mole % D. (auth)

9382
THE THEORY OF AN ELECTRICAL HIGH-FREQUENCY MASS SPECTROMETER. G. Galk and F. Schwering. Z. angew. Phys. 9, 272-5(1957) June. (In German)

MATHEMATICS

9383 AECU-3502
Sandia Corp., [Albuquerque, N. Mex.].
FEEDBACK LOGIC CIRCUITS. G. R. Bussey. May 28, 1957. 14p. Contract AT(29-1)-789. (TM-90-57-14). $3.30(ph OTS); $2.40(mf OTS).

Boolian algebra is extended to describe logic circuits employing feedbacks, such as flip-flops. Several useful circuits are mathematically synthesized, and a more general mathematical method embracing temporal effects is postulated. (auth)

9384 AERE-T/M-148
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A PROGRAMME FOR SOLVING THE TWO GROUP DIFFUSION EQUATIONS OF CYLINDRICAL REACTORS. A. Hassitt. Mar. 1957. 15p.

The program solves the two group diffusion theory equations for almost any type of cylindrical reactor. A Ferranti mark 1 computer is used. The most general problems take about an hour to solve: one dimensional problems take six minutes. The report gives an outline of the method of solution, and describes in detail the way in which the initial data are to be presented for use by the machine. (auth)

9385 CF-57-6-4
Oak Ridge National Lab., Tenn.
OPERATING INSTRUCTIONS FOR THE UNIVAC PROGRAM OCUSOL-A, A MODIFICATION OF THE EYEWASH PROGRAM. L. G. Alexander, D. A. Carrison, J. T. Roberts, and R. Van Norton. June 5, 1957. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The Eyewash program, which provides solutions of reactor criticality programs in spherical geometry by means of the group diffusion method, has been modified. The new program provides for computation and editing on the supervisory control typewriter, of the total absorptions in selected nuclides in the various regions, and for saving and transferring the final fission density distribution from one computation to the next. Modifications were also made in order to improve the treatment of intermediate reactors containing thorium. (M.H.R.)

9386 NP-6241
Shell Development Co., Houston, Tex.
TABLES FOR THE TRANSFORMATION OF ANGULAR DISTRIBUTION DATA FROM THE LABORATORY SYSTEM TO THE CENTER OF MASS SYSTEM. Jerry B. Marion and Arthur S. Ginzbarg. [1954]. 54p. $0.40(OTS).

9387 ORNL-2283
Oak Ridge National Lab., Tenn.
MATHEMATICS PANEL SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING FEBRUARY 28, 1957. June 25, 1957. 35p. Contract W-7405-eng-26. $0.30 (OTS).

The progress in programming and the use made of the Oracle is summarized. A method for solving certain Fredholm integral equations by numerically computing upper and lower step functions which serve as bounds for the solution has been developed and studied. Some experimental programming has been undertaken to test the practicality of using the quotient-difference algorithm for obtaining the roots of high-order polynomials. Research efforts have been directed toward the solution of certain maximum-likelihood problems in radiation genetic experiments, finding internal estimates of specific-locus mutation rates, and the estimation of disease incidences in populations subject to multiple causes of death. (M.H.R.)

9388 RAE-TN-GW-434
Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.
AN ANALOGUE COMPUTER FOR CONVECTIVE HEATING PROBLEMS. H. G. R. Robinson. Oct. 1956. 25p.

The computer was designed to assist in the solutions of kinetic heating problems which occur in guided weapon design. Its flexibility allows it to be used for a number of problems involving one dimensional convective heating in a wall of finite thickness, providing the basic data such as the source temperature of the convective medium and the heat transfer coefficient in the region of interest are known. Completely arbitrary time varying functions of source temperatures and heat transfer coefficient are acceptable. This note describes the design and construction of the computer. (auth)

9389 U-20123
Harvard Univ., Cambridge, Mass. Cruft Lab.
THE NATURE OF THE MONTE CARLO METHOD. Technical Report No. 137. Julian Keilson. Nov. 5, 1951. 13p. Contract N5ori-76, T. O. 1.

A survey is given of ideas underlying the various numerical approaches to the solution of differential and integral equations based on probability ideas and known as Monte Carlo methods. Monte Carlo techniques have been applied with success to such diverse problems as integration in many dimensions, the solution of ordinary, partial, integral, and differentio-integral equations, and the evaluation of the ground-state eigenvalues of Schroedinger equations. A simple presentation of the ideas underlying the Monte Carlo treatment of these problems will be attempted. (auth)

9390 UCRL-3723
California. Univ., Berkeley. Radiation Lab.
A NOTE ON LEAST-SQUARES FITTING OF ATOMIC-BEAM RESONANCE CURVES. Henry B. Silsbee. Mar. 26, 1957. 13p. Contract W-7405-eng-48. $0.20(OTS).

A routine is described for fitting bell-shaped curves to data points by use of the IBM 650 computer. (auth)

9391 WAPD-TM-20
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ATBAC—AN IBM-704 CODE FOR REACTOR THERMAL TRANSIENTS. Betty L. Anderson, Thomas J. Lawton, Joseph M. Weaver, and Edward V. Somers. May 1957. 56p. Contract AT-11-1-GEN-14. $0.40(OTS).

A method has been developed for using an IBM-704 electronic data processing machine to obtain detailed information concerning thermal conditions within a reactor core during transient operations. The method applies particularly to plate type pressurized water reactors. Solutions are obtained for heat transfer and fluid flow within normal and hot channels of the reactor. The IBM equipment required includes an 8000-word core, two tape units, and two drums. (auth)

9392
ON A SYSTEM OF MATHEMATICAL SYMBOLS CONVENIENT FOR ELECTRONIC COMPUTER OPERATIONS. L. V. Kantorovich. (Steklov Leningrad Mathematical Inst.). Doklady Akad. Nauk S.S.S.R. 113, 738-41(1957) Apr. 1. (In Russian)

9393
CODING AND COMPRESSION OF CODES. L. N. Korolev. (Inst. of Precision Mechanics and Computation Techniques). Doklady Akad. Nauk S.S.S.R. 113, 746-7(1957). Apr. 1. (In Russian)

9394
THEORY OF MULTI-COMPONENT FLUID MIXTURES. I. STATISTICAL ORDER-DISORDER ANALYSIS IN MULTI-COMPONENT FLUID MIXTURES. Zevi W. Salsburg (Rice Inst., Houston, Texas) and Peter J. Wojtowicz and John G. Kirkwood (Yale Univ., New Haven, Conn.). J. Chem. Phys. 26, 1533-41(1957) June.

The basis for a corresponding states treatment is examined in a rigorous manner by the use of statistical mechanics. A general method is given for reducing the multi-component configurational partition function to a form peculiar to a system of one component. Two types of approximations to the rigorous theory that are amenable to numerical calculations are developed on a strictly mathematical basis, and are used to estimate the magnitudes of the correction terms to a corresponding states analysis. (auth)

9395
THE INPUT AND OUTPUT SYSTEM OF THE T.I.F.R. COMPUTER. B. K. Basu and K. Bakhru (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. 45, 231-9(1957) Apr.

The logical circuits which have been incorporated in the input-output unit of a pilot electronic digital computer are described. The unit is used to feed the input data into the calculator from a punched tape through a photo-electric tape reader and to print out the results, after computation, by standard teletype equipment. (auth)

9396
A TWO DIMENSIONAL FERRITE-CORE MEMORY. M. M. Farooqui, S. P. Srivastava, and R. N. Neogi (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. 45, 240-52(1957) Apr.

A two dimensional matrix memory using ferrite cores is described. A unit consisting of 100 words of 11 binary digits each has been constructed for parallel operation. The word drive is from a biased switch-core matrix, while the digit drive makes use of pulse transformers. Logic and circuit techniques enable high discrimination between wanted and unwanted signals. A semi-automatic method for testing the memory cores is also described. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

9397 AERE-C/R-2091
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PERFORMANCE OF A SIX POSITION GRIDDED IONISATION CHAMBER FOR ALPHA ENERGY MEASUREMENTS. K. M. Glover. Nov. 1956. 19p.

The preliminary measurements and results obtained using a gridded ionization chamber built to a Chalk River design are reported. The high geometry, 50%, makes it suitable for analyzing low-activity samples or samples whose specific activity is low and the total activity is thus limited by source thickness. The six-position turntable incorporated in this instrument enables a calibration and background to be done under conditions identical with those used for the sample under investigation. (M.H.R.)

9398 AF-SAM-57-40
Texas. Univ., Austin. Radiobiological Lab.
THE LOW DOSE Co^{60} FACILITY OF THE RADIOBIOLOGICAL LABORATORY. Sanford C. Sigoloff, Henry M. Borella, Loren C. Logie, and Hugh L. Perry. Aug. 31, 1956. 9p.

The construction of a low dose-rate Co^{60} facility is described. It has proved to be versatile, reliable, and safe. Three dosimetric systems are used to measure the dose-rate of this facility. The small differences as measured by these three technics would seem to be well within experimental error. (auth)

9399 ANL-5745
Argonne National Lab., Lemont, Ill.
ON A DIFFUSION CLOUD CHAMBER TO BE USED FOR THE EXPERIMENTAL DETERMINATION OF THE HALF-LIFE OF THE NEUTRON. G. Caglioti and N. D'Angelo. June 1957. 20p. Contract W-31-109-eng-38. $0.20(OTS).

Diagrams, photographs, and specifications for the diffusion chamber, the heat exchanger, and the photographic system are given. Remarks on the operation of the chamber and data on its sensitivity are included. (M.H.R.)

9400 CEA-607
France. Commissariat à l'Energie Atomique, Paris.
SUR UNE CHAMBRE À BULLES EXPÉRIMENTAL A PROPANE. (An Experimental Propane Bubble Chamber). A. Rogozinski. Nov. 27, 1956. 25p.

A propane bubble chamber 10 cm in diameter and 5 cm deep is described. The body of the chamber is in stainless steel, and it has two windows of polished hardened glass. The compression and decompression of the propane are performed either through a piston in direct contact with the liquid, or by the action on the liquid, through a triple teflon-mylar-perbunan membrane, of a compressed gas. The general and also optimum working conditions of the chamber are described, and a few results are given concerning, in particular, the tests of the breakage-resistance of the windows and the measurements of the thermal expansion of the compressibility isotherm for the propane employed. (auth)

9401 CRL-42
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRENDS IN NUCLEAR INSTRUMENTATION. G. Cowper. May 1957. 14p. (AECL-452).

A general review of improvements in components and circuitry of radiation detection instruments is given. (M.H.R.)

9402 UCRL-3430(Rev.)

California. Univ., Berkeley. Radiation Lab.

TESTING TECHNIQUES USED IN THE QUALITY SELECTION OF RCA 6810 MULTIPLIER PHOTOTUBES. Frederick A. Kirsten. Oct. 16, 1956. 18p. Contract W-7405-Eng-48. $3.30(ph OTS); $2.40(mf OTS).

Some new methods for testing multiplier phototubes intended for scintillation or Cherenkov counting are described. These methods were developed to facilitate finding some of the more commonly occurring defects that would impair the usefulness of the phototubes. Such defects include open leads, shorts having linear and nonlinear resistances, and sources of light within the tube. (auth)

9403 UCRL-3794

California. Univ., Berkeley. Radiation Lab.

A NOBLE GAS SCINTILLATION COUNTER (thesis). Robert W. Dickieson. May 28, 1957. 34p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

Submitted to the United States Naval Postgraduate School, Monterey, Calif.

A gas scintillation counter has been built to detect the scintillations caused by the passage of charged particles through the gas. The counter consists of a photomultiplier tube which looks into the scintillation chamber through a quartz window. The output of the photomultiplier is amplified and sent to a 12-channel pulse-height analyzer. The scintillation chamber contains the radioactive source and the noble gas for scintillation. The inside walls of the chamber are coated with a good light-scattering material. The outside of the chamber is surrounded by a heating element and is immersed in a dewar of liquid nitrogen. Associated control equipment permits the noble gas to be kept in any one of the three physical states. Unfortunately pulse height is quenched, as a function of time, by the presence of contaminants in the noble gas. Water vapor is removed by the use of a cold trap. A dynamic purification system of finely divided metal was built to supply pure gas to the scintillation chamber. The effect of contamination is most evident when the noble gas scintillator is in the gaseous state. The effect is less noticeable in the liquid and solid states. The scintillation counter was first used with argon, but it is felt that the instrument could be used with any of the noble gases. It is planned that future investigations will be made using xenon, krypton, and helium. (auth)

9404 WT-1186

New York Operations Office. Health and Safety Lab., AEC.

MEASUREMENT OF OFF-SITE FALL-OUT BY AUTOMATIC MONITORING STATIONS. H. D. LeVine and R. T. Graveson. Dec. 1956. 23p. Project 30.1 [of] OPERATION TEAPOT. $0.20(OTS).

Automatic, continuously recording gamma-ray monitors placed in 28 towns adjacent to the Nevada Test Site throughout Operation Teapot showed readings no higher than 10 mr/hr; however, the continuous recording of the gamma radiation was compiled at each station. The equipment proved to be reliable and operated unattended over relatively long periods. (auth)

9405

A VERSATILE INSTRUMENT FOR THE MEASUREMENT IN r UNITS OF RADIATION DOSES. Rolf M. Sievert (Inst. of Radiophysics, Stockholm, Sweden). Arkiv Fysik 12, No. 3, 295-300(1957).

The need is stressed of extensive investigations of the doses received in occupational work with ionizing radiations, by patients undergoing medical x ray examinations, and from the natural radiation. A simple instrument, based on the condenser chamber principle, for the measurement of x rays and γ radiation in the range from the natural level of γ radiation up to 150 r has been designed for such investigations. A similar instrument is used for large stationary ion chambers, where the voltage is read by means of an attached condenser which can be sent by mail. The technical arrangements are described. (auth)

9406

FAST DIFFERENTIAL PULSE-HEIGHT ANALYZER. Dobrivoje T. Jovanović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 157-9(1957) Mar.

A pulse-height analyzer design is given which uses delaying and variable stretching techniques. The resolving time of the whole system is less than 0.4 μsec. (T.R.H.)

9407

THE DESIGN OF CALORIMETERS FOR THE DETERMINATION OF ION BEAM INTENSITIES. E. R. Harrison (Atomic Energy Research Establishment, Harwell, Berks). J. Sci. Instr. 34, 242-4(1957) June.

Calorimetric methods for determining the total particle flux of ion beams are discussed. Three types of calorimeter are described which, from experience gained with 25 to 50 ma, 10 kev and 0.2 ma mean, 500 kev proton beams, have proved suitable for this purpose. The sensitivity of the calorimeters can be either calculated from elementary theory, or obtained directly by a convenient method of calibration. (auth)

9408

ELECTROSTATIC ANALYZER OF ELECTRON VELOCITIES. V. I. Milutin and A. N. Kabanov. Uspekhi Fiz. Nauk 61, 673-98(1957) Apr. (In Russian)

9409

APPLICATION OF LUMINESCENCE CHANGES IN ORGANIC SOLIDS TO DOSIMETRY. James H. Schulman, Howard W. Etzel, and James G. Allard (U. S. Naval Research Lab., Washington). J. Appl. Phys. 28, 792-5 (1957) July.

The degradation of photoluminescence in anthracene and in naphthalene has been studied under gamma-ray and electron irradiation over the range 3×10^5 to 2×10^8 rep. For both materials the variation of brightness with Co^{60} gamma-ray dose D, in rep, may be represented by $(I/I_0) = (1 + AD)^{-1}$, where $A = 8.5 \times 10^{-7}$ for anthracene and $A = 14 \times 10^{-7}$ for naphthalene. Irradiation also produces a radiophotoluminescence in naphthalene, with emission in the visible spectral region. Both the degradation and radiophotoluminescence are stable with time at room temperature. The employment of these effects for dosimetry is discussed. (auth)

MESONS

9410

A HYPERON MODEL. G. Wentzel (Univ. of Chicago, Ill.). Helv. Phys. Acta 30, No. 2-3, 135-42(1957).

A study is made of a nucleonic particle having three elementary states of neutron, proton, and lambda character, coupled with a K-meson field by Yukawa interactions. The binding of K-mesons gives rise to a spectrum of states which contains all levels of Gell-Mann's hyperon scheme, but also other levels, all of them at higher energies with one exception. (auth)

9411

ON A POSSIBILITY OF K-MESON INVESTIGATION. L. G. Zastavenko, A. L. Liubimov, V. I. Ogievitsky, and M. I. Podgoretsky (Joint Inst. of Nuclear Research, U.S.S.R.). Nuclear Phys. 3, 549-52(1957) June.

Assuming θ and τ mesons to be different particles, one should expect the neutral τ meson life time to be considerably greater than 10^{-10} sec. This can be used in some experiments to determine the differences between θ and τ particles. Two experiments of this kind are proposed. (auth)

9412

INVARIANCE PROPERTIES AND IDENTITIES BETWEEN RENORMALIZATION CONSTANTS. A. Petermann (Univ. of Copenhagen). Nuclear Phys. 3, 592-7(1957) June.

The invariance of a given mixture of meson fields under the Stueckelberg transformation—of which the Foldy transformation is a special case—is first briefly recalled. Then, if one requires, for this mixture, the invariance under the charge renormalization group, identities between the renormalization constants are found which are the counterparts, in meson theory, of the well-known Ward identity in quantum electrodynamics. (auth)

9413

TWO-COMPONENT THEORY OF THE NEUTRINO AND K-MESON DECAYS COMPRISING TWO NEUTRINOS. S. Oneda (Univ. of Manchester). Nuclear Phys. 3, 598-605 (1957) June.

The K-meson decays comprising two neutrinos are investigated by using a two-component theory of the neutrino. The results are closely connected with the question whether the conservation of fermion numbers is valid or not. They will also give some information on the character of the primary weak interactions. (auth)

9414

EFFECT OF THE EXCLUSION PRINCIPLE ON THE INTERACTION OF K MESONS WITH NUCLEI. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 106, 1027-30(1957) June 1.

An expression is obtained for the reduction of the effective cross section of K mesons in a nucleus as a result of the exclusion principle. It is shown that this effect becomes important for incident K-meson energies below ~200 Mev. (auth)

9415

NEUTRON PRODUCTION BY μ MESONS WHICH PENETRATE LEAD. B. F. Stearns, D. R. Jones, J. K. dePagter, and R. D. Sard (Washington Univ., St. Louis, Mo.). Phys. Rev. 106, 1043-8(1957) June 1.

The mean product of cross section and multiplicity ($\langle\sigma m\rangle$) for evaporation neutrons produced when fast cosmic-ray μ mesons traverse a Pb producer has been measured. A magnet cloud chamber above the producer and a hodoscope-absorber array below it serve to identify μ mesons; neutron-producing events are selected by the detection of a delayed coincidence of a thermalized neutron with a penetrating particle. $\langle\sigma m\rangle = (22 \pm 8) \times 10^{-29}$ cm^2/nucleon. Theoretical calculations based on experimental photoneutron yields give $\langle\sigma m\rangle = 15 \times 10^{-29}$ cm^2/nucleon for the yield due to knock-on showers, and $\langle\sigma m\rangle = 9 \times 10^{-29}$ cm^2/nucleon for the direct yield from equivalent photons of the μ-meson field. This theory also agrees with the results of underground measurements at higher average momenta. There is no evidence of μ-meson scattering in excess of Coulomb scattering. Protons which suffer nuclear interactions produce more than 50 neutrons, but seldom produce penetrating secondaries. (auth)

9416

MAXIMUM LIKELIHOOD ESTIMATION OF K^+-MESON LIFETIME. D. Fournet Davis, T. F. Hoang, and M. F. Kaplon (Univ. of Rochester, N. Y.). Phys. Rev. 106, 1049-50(1957) June 1.

The method of maximum likelihood is applied to the observations of the decay in flight of K_L^+ and τ^+ mesons in emulsion. The values obtained are $(1.19 \pm 0.17) \times 10^{-8}$ sec, and $(1.06 \pm 0.53) \times 10^{-8}$ sec, respectively. Possible sources of error in the application of this method to K^- beams in emulsion are discussed. (auth)

9417

MONTE CARLO CALCULATION OF SINGLE PION PRODUCTION BY PIONS. J. E. Crew, R. D. Hill, and L. S. Lavatelli (Univ. of Illinois, Urbana). Phys. Rev. 106, 1051-6(1957) June 1.

A phenomenological calculation of single pion production in a pion-nucleon collision has been made using a $^3/_2$, $^3/_2$ isobaric nucleon model and a Monte Carlo type of calculation on a high-speed digital computer. The results are in good agreement with observations of pion production for incident pion energies of approximately 1.0 and 1.5 Bev. (auth)

9418

DISINTEGRATION OF HYPERFRAGMENTS. III. J. Schneps (Tufts Univ., Medford, Mass.) and W. F. Fry and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 106, 1062-71(1957) June 1.

The systematic study of hyperfragments using nuclear emulsion, has been continued. Examples of $_\Lambda H^4$, $_\Lambda He$, and $_\Lambda Li$ hyperfragments are reported here. Λ^0 particle binding energies previously reported have been corrected according to the latest range-energy data of Barkas et al. Average values found for the binding energy B_Λ are given. The absence of $_\Lambda H^2$ indicates the Λ^0-nucleon system does not have a bound state. The absence of $_\Lambda He^3$ implies that $_\Lambda H^3$ is an isotopic spin singlet. The agreement in the binding energies of $_\Lambda H^4$ and $_\Lambda He^4$ supports the hypothesis of charge independence for Λ^0-nucleon forces. The ratios of nonmesonic to mesonic decays of hyperfragments $Q^{(-)}$, as defined by Ruderman and Karplus, are found to be: for H hyperfragments $Q^{(-)} = 0$; for He $Q^{(-)} = 1.5$; for hyperfragments of $Z \geq 3$, $Q^{(-)} = 43$. According to the analysis of Ruderman and Karplus these values suggest that the Λ^0 particle decays into an angular momentum state of $l = 0$ or $l = 1$, and hence that the spin of the Λ^0 is either $^1/_2$ or $^3/_2$. In the case of hyperfragments which decay into a proton, π^- meson, and a recoil, the angle $\theta_{\Lambda\pi}$ between the π^--meson direction in the Λ^0 rest frame and the direction of motion of the Λ^0 within the hyperfragment can be measured, if it is assumed that the interaction of the decay particles is negligible. The distribution of these angles shows a peaking in the forward and backward directions. This is suggestive of a spin greater than $^1/_2$ for the Λ^0. (auth)

9419

Λ^0-NUCLEON INTERACTION. Ernest M. Henley (Univ. of Washington, Seattle). Phys. Rev. 106, 1083-9(1957) June 1.

A study of the Λ^0-p or Λ^0-n force is of particular interest because the Λ^0-nucleon two-body force need not be related to the potential effective in binding hyperfragments. Thus, an exchange of a single pion between the Λ^0 and the nucleon is forbidden only in the two-body interaction. It is pointed out that the final-state interaction in the production of a Λ^0 and nucleon is the only effective means of studying this force that seems feasible at present. The effect of the Λ^0-nucleon interaction on the spectrum of K mesons produced in nucleon-nucleon and pion-deuteron collisions is investigated. It is pointed out that these experiments can also be used to determine whether the $_\Lambda H^2$ is bound. (auth)

9420

PION PRODUCTION IN PION-NUCLEON COLLISIONS. Leonard S. Rodberg (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 1090-9(1957) June 1.

The production of a single pion in pion-nucleon collisions has been studied by using the Chew-Low formalism with p-wave coupling. The equation for the T-matrix is solved by using the one-meson approximation. The solution is used to compute the cross sections for pion production and the two-meson corrections to the scattering equation of Chew and Low. The production cross sections show a peak due to overlapping final-state resonances, but have a magnitude of less than 2 mb, compared to the observed inelastic cross sections of about 20 mb (near 1 Bev). The two-meson corrections to scattering are found to be quite small. (auth)

9421

THREE-PION DECAY MODES OF NEUTRAL K MESONS. A. Pais (Inst. for Advanced Study, Princeton, N. J.) and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 106, 1106-7(1957) June 1.

Certain effects are pointed out which obtain in 3π-decay of neutral K mesons if it is true that invariance under CP and T, rather than under C, P, and T separately, is valid for all weak interactions (C = charge conjugation, P = space inversion, T = time reversal). (M.H.R.)

9422

PION-NUCLEON INTERACTIONS. S. J. Lindenbaum and R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 106, 1107-8(1957) June 1.

An explanation of experimental data is attempted on the basis that the behavior of the cross section of the isotopic spin states of $\frac{1}{2}$ can be explained by assuming that all pion-nucleon interactions of pion kinetic energy less than 1.5 Bev proceed via excitation of this one state. (M.H.R.)

9423

MAGNETIC RESONANCE DETERMINATION OF THE MAGNETIC MOMENT OF THE μ MESON. T. Coffin, R. L. Garwin, L. M. Lederman, S. Penman, and A. M. Sachs (Columbia Univ., New York). Phys. Rev. 106, 1108-10 (1957) June 1.

A precise determination of the magnetic moment of the μ^+ meson gives a g factor of $+2.0064 \pm 0.0048$. The resonance apparatus is diagramed. (M.H.R.)

9424

POLARIZATION OF ELECTRONS IN MUON DECAY AND THE TWO-COMPONENT THEORY OF THE NEUTRINO. Toichiro Kinoshita and Alberto Sirlin (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 106, 1110-11(1957) June 1.

It is pointed out that the longitudinal polarization of an electron emitted from a muon at rest gives further information about the nature of the muon decay interaction in the two-component theory. The discussion presented is valid only insofar as the electron mass is negligible compared with its momentum. (M.H.R.)

9425

THE ANGULAR DISTRIBUTION OF MUONS FROM π-μ DECAY. F. Bruin and M. Bruin. Physica 23, 551-2(1957) June.

The projected angles between the initial directions of pions and their decay muons were measured in two 600 μ G5 emulsion stacks exposed to the K beam of the Berkeley Bevatron. The pions investigated were produced either in the emulsion or in nearby material. The results indicate an isotropy of distribution. (M.H.R.)

9426

THE ANGULAR DISTRIBUTION OF CHARGED K^+-MESON SECONDARIES. F. Bruin and M. Bruin. Physica 23, 553-4 (1957) June.

K mesons from the Berkeley Bevatron having an energy of 175 and 210 Mev respectively were selected by a magnetic lens and analyzing system. A histogram of the results is given which does not show a significant deviation from an isotropic distribution. (M.H.R.)

9427

NEW SYMMETRY PROPERTIES OF ELEMENTARY PARTICLES. A. A. Abrikosov and I. M. Khalatnikov (Vavilov Moscow Inst. of Problems in Physics). Priroda 46, No. 5, 5-10(1957) May. (In Russian)

A review is given of the even parity and symmetry theory of K mesons. (R.V.J.)

9428

THE STRANGE PARTICLES. (THE SCHEME OF ISOTOPIC MULTIPLICITY). L. Okun. Uspekhi Fiz. Nauk 61, 535-59(1957) Apr. (In Russian)

Experimental investigations and theoretical analysis of the formation and decay of heavy mesons and hyperons demand a new, more comprehensive approach to isotopic spin and to some already established physical concepts. Studies were made of the mass and decay schemes of K mesons and hyperons. Interaction between π mesons and heavy particles and isotopic spin of π mesons and nucleons, K mesons, and hyperons are analyzed with respect to their value and isotopic properties. Strong interactions $\Delta S = 0$ and $\Delta T = 0$, electromagnetic interactions $\Delta S = 0$, decay of the heavy particles $\Delta S = 1$, $\Delta T = \pm \frac{1}{2}$, and other possible particles in the scheme of isotopic multiplicities were investigated. An appendix of formulas which developed the wave functions with isotopic spins T_1 and T_2 and projections T_1^3 and T_2^3 expressed by specific functions of the operator of total isotopic spin T and projection T_3 is included. (R.V.J.)

MOLECULAR PROPERTIES

9429

NEUTRON DIFFRACTION. 3. THE STUDY OF MOLECULAR STRUCTURE. G. E. Bacon (Atomic Energy Research Establishment, Harwell). Research (London) 10, 241-8(1957) June.

NEUTRONS

9430 AERE-RP/M-115

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A NOTE ON THE SLOWING-DOWN AREA IN IRON. C. C. Horton. Mar. 1957. 8p. (SWP/P-40).

The slowing-down area for fast neutrons diffusing in iron is a quantity of importance in shielding calculations, especially those in which thick thermal shields of iron are considered. The value of the slowing-down area, τ, is calculated as a function of neutron energy up to 2 Mev. The importance of inelastic scattering is considered by an approximation which treats inelastic scattering as a special case of scattering with a large average energy loss. (auth)

9431 NARF-57-21T

Convair, Fort Worth, Tex.

NEUTRON ENERGY SPECTRA FOR INFINITE MULTIPLYING MEDIA. J. C. Couchman. May 29, 1957. 16p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-162).

A numerical method is developed for calculating neutron

energy spectra for infinite multiplying media. The method includes joining the slowing down spectrum to a thermal distribution. The spectrum extends in energy up to 10 Mev. The method is applied to an eighteen-group treatment to show the relative spectral effects of C and water in various moderator-to-U^{235} ratios. (auth)

9432 UCRL-4808

California. Univ., Livermore. Radiation Lab.

THE APPLICATION OF PULSED NEUTRON SOURCES TO CRITICALITY MEASUREMENTS. Lawrence Passell, Joel Bengston, and Donald C. Blair. Jan. 30, 1957. 12p. Contract [W-7405-eng-48]. $3.30(ph OTS); $2.40(mf OTS).

Experimentally measured prompt-neutron decay constants for subcritical systems are of considerable value as normalization data for calculations of prompt-neutron time constants. A method of measuring these decay constants with a pulsed neutron source, neutron detector and multichannel time-delay analyzer has been developed and used on a number of fast-spectrum subcritical systems. An analysis of this method based on the one-energy group, one-delayed-neutron group reactor kinetic equations is presented and discussed. The curve of neutron flux versus time predicted by the kinetic equations is compared with the observed curve obtained with a 13.1-cm diam. enriched-U sphere to indicate the application and limitations of the analysis. (auth)

9433

SCATTERING OF NEUTRONS BY SPIN WAVES IN MAGNETITE. B. N. Brockhouse (Atomic Energy of Canada Ltd., Chalk River, Ontario). Phys. Rev. 106, 859-64(1957) June 1.

Measurements of energy distributions of 1.5 A neutrons diffusely scattered by a single crystal of magnetite in the region of the 111 reciprocal lattice point were carried out. Neutron groups were observed which satisfy momentum and energy conservation between the neutron and one wave-excitation quantum, and which are assigned a magnetic origin. The intensities of the neutron groups are consistent with spin wave theory within the limits of the analysis. The measurements are not sufficiently exact to enable the form of the frequency-wave number relation of the spin waves to be deduced, but assuming the quadratic relation of Kaplan a value for the A-B exchange integral of 2×10^{-3} ev is obtained. (auth)

9434

ON A TIME OF FLIGHT METHOD OF STUDYING THE VELOCITY DISTRIBUTION OF NEUTRONS FROM DIFFUSING MEDIA. V. C. Deniz, S. B. D. Iyengar, and R. Ramanna (Atomic Energy Establishment, Trombay, Bombay). Proc. Indian Acad. Sci. 45, 205-14(1957) Apr.

The velocity distribution of slow neutrons emerging from the surfaces of finite moderator assemblies due to a pulse of fast neutrons was studied at various points outside the assembly normal to its surface. The distributions were investigated theoretically and the experimental results were correlated with velocity distributions inside the medium. (T.R.H.)

9435

SLOWING DOWN AND DIFFUSION OF NEUTRONS IN BERYLLIUM OXIDE. S. B. D. Iyengar, G. S. Mani, R. Ramanna, and N. Umakanth (Atomic Energy Establishment, Trombay, Bombay). Proc. Indian Acad. Sci. 45, 215-23(1957) Apr.

Neutron slowing down and diffusion constants of BeO at 24°C were determined by studying the decay rate of thermal neutrons due to an initial instantaneous burst of fast neutrons. (T.R.H.)

9436

TEMPERATURE DEPENDENCE OF THE SLOWING DOWN AND DIFFUSION CONSTANTS OF NEUTRONS IN BERYLLIUM OXIDE. S. B. D. Iyengar, G. S. Mani, R. Ramanna, and N. Umakanth (Atomic Energy Establishment, Trombay, Bombay). Proc. Indian Acad. Sci. 45, 224-30(1957) Apr.

NUCLEAR PHYSICS

9437

A CONTRIBUTION TO THE INTERPRETATION OF THE (d,p) REACTION PRODUCED BY LOW ENERGY DEUTERONS. Mira K. Jurić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 1-16(1957) Mar.

An attempt was made to explain the mechanism of the (d,p) reaction produced by deuterons of the energy lower than the Coulomb barrier. Experimental curves of the angular distribution of protons from the (d,p) reaction on Be^9, C^{12}, and O^{16} have been compared with theoretical curves obtained by means of the Tobocman-Kalos method. From the agreement between experimental and theoretical curves, it could be concluded that stripping is dominant also at low deuteron energies. Besides the Butler and Coulomb effects, the angular distribution is greatly influenced by the effects of interaction between the particles of the reaction. (auth)

9438

NUCLEAR LEVELS AND SHELL STRUCTURE. K. Bleuler and Ch. Terreaux. Helv. Phys. Acta 30, No. 2-3, 183-205 (1957).

The experimental results concerning binding energies and level schemes from all heavier odd neutron nuclei ($A > 30$) are studied. A new graphical method is introduced in order to obtain a comprehensive survey of these values throughout the periodic table by means of a system of curves. With the help of this geometrical representation a detailed comparison with the corresponding results from the shell model is made. There is a striking agreement in a large part of the periodic system. Typical deviations are found in the domain of large level density of the spherical shell structure (corresponding to the region of deformed nuclei). From this comparison it is possible to determine a phenomenological expression for the spin orbit coupling term. This interaction agrees with the results obtained from an analysis of the scattering of polarized protons. It is then proved that the same coupling law also holds in the region of light nuclei. Some preliminary considerations about the pseudoscalar meson field in relation to our large spin orbit interaction are given at the end of the paper. (auth)

9439

PERTURBATION APPROACH TO THE FERMI GAS MODEL OF HEAVY NUCLEI. N. M. Hugenholtz. Physica 23, 533-45(1957) June.

The general perturbation method presented in an earlier paper is applied to a study of some aspects of the Fermi gas model of nuclear matter. The two extreme cases of very low and very high particle density are investigated. It is shown that the theory recently developed by Brueckner can be considered as an improved low density approximation. The validity of some other approximations made in the Brueckner theory, involving the energy denominators in intermediate states are briefly discussed. The study of the case of high density reveals the interesting fact that, contrary to indications presented by Swiatecki and Bethe, the convergence of the perturbation expansion gets worse

with increasing density, while in that case the Brueckner approximation becomes extremely poor. It is furthermore shown that a slow nucleon, travelling through nuclear matter, can be considered as being in a metastable state and an exact expression for the inverse life-time of such a state is given; this quantity must be identified with the imaginary part of the potential in the optical model. (auth)

NUCLEAR PROPERTIES

9440 AERE-NP/R-2140

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TABLE OF CONSISTENT NUCLEAR DATA FOR U^{233}, U^{235}, AND Pu^{239} FOR 2200 M/SEC NEUTRON. P. A. Egelstaff, K. W. Morton, and J. E. Sanders. Dec. 1955. 11p.

Five quantities relating to the behavior of fissile isotopes are tabulated for U^{233}, U^{235}, and Pu^{239}. These quantities are the average number of neutrons emitted per fission, the average number of neutrons emitted per neutron absorbed, σ_a, the absorption cross section, σ_f the fission cross section and the ratio $(\sigma_a - \sigma_f)/\sigma_f$. (M.H.R.)

9441 ANL-5738

Argonne National Lab., Lemont, Ill.

HALF-LIFE LIMIT ON Mn^{53}. J. R. Huizenga and J. Wing. June 1957. 6p. Contract W-31-109-eng-38. $0.15(OTS).

A manganese sample containing a Mn^{53}/Mn^{54} atom ratio of 5.46×10^3 was studied with proportional and scintillation spectrometers. No radiations of Mn^{53} were observed, in contradiction to results previously reported. The absence of Mn^{53} K X rays leads to a lower limit of 1.3×10^5 years for the Mn^{53} half-life. This result is in agreement with the recently measured spin I = 7/2 for Mn^{53}. (auth)

9442 LA-2127

Los Alamos Scientific Lab., N. Mex.

Pu^{239} CROSS SECTIONS AND THEIR TEMPERATURE DEPENDENCE. Joseph Devaney, Max Goldstein, and Bertha Fagan. Mar. 1957. 66p. Contract W-7405-eng-36. $0.40(OTS).

A single level Breit-Wigner analysis of Pu^{239} is folded into a Maxwell velocity distribution to obtain total, scattering, fission, and radiative capture cross sections versus energy for neutron energies of 0.025 to 43 ev, and for Pu^{239} temperatures of 0.0253 to 50 ev. (auth)

9443 AEC-tr-2935

SIMPLE CAPTURE OF THERMAL NEUTRONS AND RESONANCE NEUTRONS BY URANIUM. Hans von Halban, Jr., Lew Kowarski, and Paul Savitch. Translated from Compt. rend. 208, 1396-8(1939). 3p.

The cross section of U for simple thermal neutron capture was found to be 1.3 ± 0.45 b. The relative width of the resonance band for resonance neutron capture was studied. (M.H.R.)

9444

ELECTROMAGNETIC MULTIPOLE RADIATION. R. H. Good, Jr. (Pennsylvania State Univ., University Park and Iowa State Coll., Ames). Annals of Physics 1, 213-20 (1957) June.

A derivation of the electromagnetic multipole radiation formulas is given which emphasizes the parallel between the radial problem for photons and the radial problem for Schrödinger or Dirac particles. The Maxwell equations are rewritten in Hamiltonian form, simultaneous eigenfunctions of the square of the angular momentum operator, its z component, and the Hamiltonian are found, and the outgoing waves are selected from these. (auth)

9445

THE 148-keV ELECTRIC QUADRUPOLE TRANSITION IN Tl^{200}. B Åström, B. Johansson, and I. Bergström (Nobel Inst. of Physics, Stockholm, Sweden). Arkiv Fysik 12, No. 3, 205-14(1957).

The relative conversion intensities of the 148 kev transition in Tl^{200} have been measured and the result unambiguously suggests a pure E2 transition. It is shown that the 148 kev gamma ray is emitted from a 0− state to the 2− ground state in Tl^{200}. Delayed coincidence measurements showed that the half life of the first excited state (0−) is 8 ± 2 mμsec. The coincidence arrangement used is described in some detail. (auth)

9446

ELASTIC SCATTERING OF 5.7 Mev PROTONS FROM Ni AND Cu. Minoru Takeda, Michiya Kondo, Syohei Kato, Chuin Hu, Ryuzo Nakasima, and Shotaro Yamabe (Osaka Univ.). J. Phys. Soc. Japan 12, 561-4(1957) June.

Protons (5.7 Mev) from the cyclotron were used to study the angular distributions of protons elastically scattered from Ni and Cu by means of nuclear emulsion technique. The angular distributions were measured from 14 to 161° at an interval of 5° in the laboratory system. The differential cross sections, in the ratio to the Rutherford cross section, have a minimum at about 85° in both cases, but at large scattering angles the cross section for Ni increases linearly, while there is a maximum at about 130° in the case of Cu. The results are in essential agreement with those of Bromley and Wall. (auth)

9447

ANOMALOUS INTERNAL CONVERSION RATIOS OF E3 TRANSITIONS IN THE REGION Z = 77−82. G. Andersson (Gustaf Werner Inst. for Nuclear Chemistry, Uppsala) and I. Bergstrom (Nobel Inst. of Physics, Stockholm). Nuclear Phys. 3, 541-8(1957) June.

A systematic disagreement between experimental and theoretical L conversion ratios has been observed for E3 transitions in Pb, Tl, Au, and Ir. It is shown that multipole mixing cannot explain the discrepancies and that a nuclear size effect seems very improbable. (auth)

9448

ISOTOPIC ASSIGNMENT OF SLOW NEUTRON RESONANCES IN GERMANIUM, RUBIDIUM, NEODYMIUM AND TUNGSTEN. Eleanor M. Bowey (Atomic Energy Research Establishment, Harwell). Nuclear Phys. 3, 553-60(1957) June.

A scintillation detector measured the yield of gamma rays due to neutron capture in a sample placed in a neutron beam, and it was shown that even when only very small samples of the capturing material are available this provides a sensitive method for the detection of neutron resonances. The separated isotopes of the elements germanium, rubidium neodymium, and tungsten have been studied, and the results are shown as gamma ray yield curves. (M.H.R.)

9449

EMPIRICAL DETERMINATION OF NUCLEAR SHAPE FACTORS AND MOMENTS OF INERTIA. E. D. Klema and R. K. Osborn (Oak Ridge National Lab., Tenn.). Nuclear Phys. 3, 571-84(1957) June.

The results of certain experiments sensitive to nuclear shapes are correlated in terms of the kinematical model used previously for the correlation of nuclear ground-state properties. The data considered in the present work are the energies of the rotational levels of even nuclei, (i.e. nuclei with even numbers of protons and neutrons), the probabilities of electrodynamically-induced transitions between these levels, and the quadrupole moments of odd-mass nuclei. The dynamics of the system represented by the model is treated purely empirically and is presumed to

be characterized by a small set of well-defined physical parameters. The principal empirical conception investigated below is that of the fraction of nuclear matter which participates in collective rotational motion, and its implications for the correlation of nuclear shapes as determined from the data mentioned above. This fraction is taken to be the ratio of the number of particles outside of filled major shells (both protons and neutrons) or the number of holes, whichever is smaller, to the total number of particles in the nucleus. The correlation obtained suggests the possibility of estimating the quadrupole moments of odd-mass nuclear ground states from the superior experimental data on neighboring even-nuclei, and this suggestion is pursued where possible. It is found that the moments so calculated exhibit no consistent deviations from the experimental values. (auth)

9450

SPACE-TIME REFLECTIONS AND ISOBARIC SPIN. J. C. Taylor (Imperial Coll. of Science and Tech., London). Nuclear Phys. 3, 606-11(1957) June.

An 8-component spinor representation of the extended Lorentz group is identified with the proton-neutron doublet. Electromagnetic interactions break invariance under Schwinger time reversal but not Wigner time reversal. This is analogous to the way in which weak interactions break parity invariance. A similar representation can be assigned to the Λ particle, if it is a parity doublet. (auth)

9451

STOPPING POWER OF SOME METALLIC ELEMENTS FOR 19.8-Mev PROTONS. V. C. Burkig and K. R. MacKenzie (Univ. of California, Los Angeles). Phys. Rev. 106, 848-51(1957) June 1.

The proton beam of the UCLA cyclotron, adjusted to 19.8 Mev, was used to measure the stopping power per electron relative to aluminum for 23 elements from Be to Th. An approximate straight-line relationship was found as a function of log Z with deviations noted from Ta to Th, and from Ca to Fe. The latter deviation seems to be associated with the number of electrons in the 3d shell. (auth)

9452

HYPERFINE STRUCTURE OF POSITRONIUM IN ITS GROUND STATE. V. W. Hughes (Columbia Univ., New York and Yale Univ., New Haven, Conn.) and S. Marder and C. S. Wu (Columbia Univ., New York). Phys. Rev. 106, 934-47(1957) June 1.

The energy difference between orthopositronium and parapositronium in the ground n = 1 state, which is called the hyperfine structure separation $\Delta\nu$, has been determined. The frequency difference between the M = ±1 and the M = 0 Zeeman levels of orthopositronium was measured in a static magnetic field of 8000 gauss at which it is about 2460 Mc/sec. A resonance curve was taken with fixed frequency by varying the magnetic field, and an observed fractional line width, $\Delta H_0/H_{0_r}$, of about 4.5×10^{-3} was obtained. The principal part of the line width (3.6×10^{-3}) is due to the annihilation lifetime of positronium; microwave power broadening and magnetic field inhomogeneity account for the remainder. No Doppler broadening is present despite the high velocity of the positronium atoms, because the mean free path of a positronium atom in the gas is small compared to the wavelength of the microwave radiation. The value of $\Delta\nu$ was computed from the observed values of the frequency and magnetic field at resonance by use of the Breit-Rabi formula to give the result: $\Delta\nu = (2.0333 \pm 0.0004) \times 10^5$ Mc/sec. The error quoted is 5 times the statistical error and is believed to represent an upper limit to possible systematic errors. The value agrees with the values of Deutsch et al. of $(2.0338 \pm 0.0004) \times 10^5$ Mc/sec and $(2.0335 \times 0.0005) \times 10^5$ Mc/sec, obtained with fields of 9500 and 9000 gauss, respectively, and hence confirms the use of the Breit-Rabi formula. The experimental values agree with the theoretical value for $\Delta\nu$ of 2.0337×10^5 Mc/sec computed to order α^3 ry by Karplus and Klein. (auth)

9453

RATIO OF THE MAGNETIC MOMENTS OF In^{115} AND In^{113}. Michael Rice and R. V. Pound (Harvard Univ., Cambridge, Mass.). Phys. Rev. 106, 953(1957) June 1.

A new measurement of the ratio of the nuclear magnetic resonance frequencies of In^{115} and In^{113} in a solution of $In(ClO_4)_3$ yields $\mu(In^{115})/\mu(In^{113}) = 1.0021437 \pm 0.0000012$ This can be combined with the hfs measurements of Eck et al. to determine the hfs anomalies. (auth)

9454

Hfs OF THE 5 $^2P_{1/2}$ STATE OF In^{115} AND In^{113}: Hfs ANOMALIES IN THE STABLE ISOTOPES OF INDIUM. T. G. Eck, A. Lurio, and P. Kusch (Columbia Univ., New York). Phys. Rev. 106, 954-7(1957) June 1.

The hfs splittings of the 5 $^2P_{1/2}$ states of In^{115} and In^{113} have been measured by the atomic-beam magnetic-resonance method. The values $\Delta\nu(In^{115}) = [11\ 409.7506 \pm (20)] \times 10^6$ and $\Delta\nu(In^{113}) = [11\ 385.4300 \pm (20)] \times 10^6$ sec^{-1} are found. A comparison of the ratio of the dipole coupling constants of the two isotopes in the $P_{1/2}$ state and in the $P_{3/2}$ state with the ratio of the nuclear g_I factors yields the following hfs anomalies: $\Delta_{1/2} = (7.5 \pm 1.3) \times 10^{-6}$, $\Delta_{3/2} = -(23.8 \pm 1.3) \times 10^{-6}$. The fractional change in the nuclear radius between In^{113} and In^{115}, $\delta R/R$, is found to be 3.66×10^{-3} as compared to 5.85×10^{-3} calculated on the assumption of an incompressible nucleus. (auth)

9455

Hfs OF THE 5 $^2P_{3/2}$ STATE OF In^{115} AND In^{113}: OCTUPOLE INTERACTIONS IN THE STABLE ISOTOPES OF INDIUM. T. G. Eck and P. Kusch (Columbia Univ., New York). Phys. Rev. 106, 958-64(1957) June 1.

The zero-field hfs interval in the 5 $^2P_{3/2}$ state of In^{115} and In^{113} have been measured by the use of conventional atomic-beam techniques. The magnetic octupole interaction constants for these atomic systems are determined from the measured intervals and corrected for perturbations of the electronic states. They are $c'(In^{115}) = [0.001702 \pm (35)] \times 10^6$, $c'(In^{113}) = [0.001728 \pm (45)] \times 10^6$ sec^{-1}. The estimated values of the nuclear magnetic octupole moments of In^{115} and In^{113} are compared to the predictions of the single-particle and collective models of the nucleus. (auth)

9456

RADIATIVE TRANSITION WIDTHS IN THE 1p SHELL. Dieter Kurath (Argonne National Lab., Lemont, Ill.). Phys. Rev. 106, 975-82(1957) June 1.

The nuclear wave functions, obtained from a shell model with variable strength of spin-orbit coupling, are used to compute M1 and E2 transition widths. Comparison with experiment is made for Be^8, B^{10}, B^{11}, and C^{12}. The agreement is not nearly so good as was that obtained for energy level schemes. The pure M1 transitions are in good agreement with experiment. The values computed for E2 transition strengths are found to be generally low, though about the right order of magnitude. This suggests the need for adding some collective behavior to the model. (auth)

9457

ENERGY LEVELS IN Na^{23} AND Ne^{20}. W. W. Buechner and A. Sperduto (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 1008-11(1957) June 1.

The energy levels in Na^{23} and Ne^{20} have been investigated by means of the reactions $Na^{23}(p,p')Na^{23}$ and $Na^{23}(p,\alpha)Ne^{20}$. Protons with energies of 7.04, 7.17, and 7.45 Mev were accelerated with an electrostatic generator, and the reac-

tion products were analyzed with the broad-range spectrograph at various angles between 45 and 130 degrees. Proton groups were observed corresponding to levels in Na^{23} at 0.440, 2.078, 2.393, 2.641, 2.705, 2.983, 3.678, 3.850, 3.915, 4.431, and 4.778 Mev. The ground-state Q value for the $Na^{23}(p,\alpha)Ne^{20}$ reaction was determined as 2.370 ± 0.008 Mev. Four other alpha-particle groups were observed, corresponding to levels in Ne^{20} at 1.635, 4.248, 4.969, and 5.631 Mev. (auth)

9458

MEASUREMENT OF THE SPIN AND GYROMAGNETIC RATIO OF As^{76}. F. M. Pipkin and J. W. Culvahouse (Harvard Univ., Cambridge, Mass.). Phys. Rev. 106, 1102-4(1957) June 1.

The spin and gyromagnetic ratio of 27-hour As^{76} have been measured by using the γ-ray anisotropy induced by several types of r-f magnetic fields applied to a Si crystal containing 5×10^{10} As^{76} atoms. The spin is 2 and the ratio, -0.453 ± 0.002. (M.H.R.)

9459

LONGITUDINAL POLARIZATION OF BETA-PARTICLES FROM ^{60}Co, ^{32}P AND ^{170}Tm. H. de Waard and O. J. Poppema. Physica 23, 597-8(1957) June.

Typical left-right asymmetries and theoretical and experimental values of the degree of polarization are tabulated. The absolute value of the degree of polarization for Co^{60} and P^{32} appears to be smaller than the expected value. The negative sign of the polarization shows that spin and momentum directions of the emitted electrons are opposite both for the allowed decays of Co^{60} and P^{32} and for the first order forbidden decay of Tm^{170}. The value for Tm^{170} has the same magnitude as for the allowed transitions though this somewhat smaller value of polarization may be caused by the thickness of the source. (M.H.R.)

9460

ROTATION PHASES OF ATOMIC NUCLEI. Gerhart Lüders. Z. Naturforsch. 12a, 353-62(1957) May. (In German)

9461

THE DECAY OF Ga^{65}. I. HALF LIFE AND β SPECTRA. H. Daniel. Z. Naturforsch. 12a, 363-5(1957) May. (In German)

9462

DECAY OF Ga^{65}. II. γ-SPECTRA AND COINCIDENCE MEASUREMENTS. Th. Mayer-Kuckuk. Z. Naturforsch. 12a, 365-7(1957) May. (In German)

NUCLEAR REACTORS

9463 AECL-356

Canadian General Electric Co., Ltd., Toronto.

CANADA'S FIRST NUCLEAR POWER STATION. [Jan. 1957]. 50p.

A general description of the Nuclear Power Demonstration facilities is given. Discussions are included on historical background, station description, reactor plant, reactor, reactor core, pressure vessel, primary heat transfer system, moderator system, shell cooling system, heavy water purification, helium systems, fuel, fuel handling, turbine plant, reject condenser system, building, staff requirements, waste disposal, ventilation, heavy water conservation, and electrical services. (M.H.R.)

9464 AECU-3499

North American Aviation, Inc., Downey, Calif.

FUEL ELEMENT ECONOMICS IN SODIUM GRAPHITE POWER REACTORS. B. R. Hayward and C. C. Woolsey. Dec. 1955. 12p. $3.30(ph OTS); $2.40(mf OTS).

Reactor fuel element economics is a complex subject requiring careful analysis of a complete fuel cycle. While present fuel element operating temperature limitations pose a severe restriction to lowering electrical power output costs, U alloy fuel materials now being studied should permit higher operating temperatures. Simplification of fuel element design and the choice of processing cycle offer additional means of reducing costs. (auth)

9465 AERE-R/R-2150

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECTIVENESS OF NEUTRONS AS A FUNCTION OF THEIR ENERGY IN THE NATURAL URANIUM ENVELOPE OF ZEPHYR. H. Rose and R. M. Absalom. Mar. 4, 1957. 14p. $0.45(OTS).

The variation of neutron effectiveness with energy has been investigated in the natural U envelope of Zephyr. The experiments involved using the reactor in a steady, subcritical condition, and measuring the relative changes in reactor flux produced by calibrated neutron sources of different mean energies when inserted into the reactor envelope. In all, five photo-neutron (γ,n) and two (α,n) sources were used, ranging in average energy from 0.03 to 5.0 Mev. Measurements were carried out at five positions, and results obtained for the dependence of neutron effectiveness upon neutron energy and also upon distance from the reactor core. It is shown that the lower energy neutrons (< about 100 kev) in the envelope contribute very little to the reactivity of the Zephyr system. (auth)

9466 AERE-R/R-2167

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FUEL RECYCLING IN EQUILIBRIUM THORIUM SINGLE REGION THERMAL REACTORS. J. J. Syrett and J. A. Dyson. Apr. 1, 1957. 20p. (SGP/P-8).

An equilibrium system is considered, comprising a single zone thermal reactor fuelled with an equilibrium mixture of Th, U^{233}, and higher isotopes, with a continuous feed of U^{235} and Th to maintain equilibrium. An expression is derived for the number of atoms fissioned for each atom of U^{235} fed into the system, and some numerical examples are given. It is shown that the feed of U^{235} required is in general reduced by under-moderation. (auth)

9467 AERE-RS/L-4

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

BURST SLUG DETECTION. Notes of a Lecture Given at the Reactor School on Thursday, November 4th, 1954. N. A. Faull. Dec. 14, 1954. 9p.

Methods are presented for the detection of burst slugs in reactors. The reasons for failure and ways to prevent failure are discussed. (W.L.H.)

9468 CF-57-1-87

Oak Ridge National Lab., Tenn.

HRT SAMPLER DEVELOPMENT. B. A. Hannaford. Jan. 22, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A prototype sampler for obtaining samples of highly radioactive UO_2SO_4 solution for use in the HRT is presented. It was successfully operated in conjunction with a low pressure water system and a high-pressure, high-temperature UO_2SO_4 system. (W.L.H.)

9469 CF-57-4-87

Oak Ridge National Lab., Tenn.

REPORT OF SLURRY BLANKET TEST RUN SM-2. L. F. Parsly, Jr., H. L. Falkenberry, and I. M. Miller. Apr. 29, 1957. 73p. Contract [W-7405-eng-26]. $12.30 (ph OTS); $4.50(mf OTS).

Run SM-2 was run to determine whether a sulfated ThO_2 slurry could be handled in a hydrodynamic system similar to the HRT test blanket. It was found that the ThO_2 concentration circulating in the pipes was consistently 50% or less of the expected concentration based on the quantity of oxide changed. The run lasted 1730 hours. It was terminated because of a slurry leak a few days before a shutdown had been scheduled. Severe erosion was found in the pump impeller and flow nozzle. Chloride concentrations high enough to cause concern over possible stress corrosion cracking occurred on several occasions in the pressurizer. (W.L.H.)

9470 CF-57-5-96
Oak Ridge National Lab., Tenn.
FINAL PROCESS DESIGN FOR LEAK DETECTOR SYSTEM FOR SPECIAL FLANGES. E. A. Mason. May 29, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The leak detector system consists of one gas pressurized reservoir containing heavy water, a tubing manifold connecting the pressurizer to six separate lines each connected to one of the flanges, tubing lines leading from the second hole on each of three flange pairs (dome and heat exchanger flanges) back into the instrument room, plus required valves and fittings. A schematic diagram of the system is included. (M.H.R.)

9471 CF-57-6-25
Oak Ridge National Lab., Tenn.
HRT LETDOWN VALVES. A. M. Billings. June 5, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

Details of letdown valve service on the HRT Mockup are described. (W.L.H.)

9472 CF-57-6-51
Oak Ridge National Lab., Tenn.
FUEL EXPOSURES IN HETEROGENEOUS THORIUM BREEDER REACTORS. B. E. Price and S. Jaye. June 13, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The results indicate that heterogeneous Th-U^{233} systems can, under specialized assumptions, achieve exposures of 10,000 Mwd/t and above with retainment of the initial fuel inventory. These calculations are based on a single-region spherical reactor, containing U^{233}-Th rods on an 8-in. lattice pitch and moderated with D_2O. The assumptions are made of operation with no structural poisons, no Pa^{233} losses, uniform fuel exposure, and control by fuel concentration. Graphs of the initial breeding ratio (IBR) and the fuel exposure as functions of Th concentration are presented. Size was treated as a parameter, and the calculations were performed for reactor diameters of 12 ft and 14 ft. For diameters less than about 12 ft and practical Th concentrations, the IBR drops below unity. For a given diameter, the IBR and exposure are expected to be between the curves labeled x = 0.03 and 0.05, which are the assumed limits of fraction of constant fission product poisons. It is concluded that, even with the special assumptions made, the results appear to warrant further investigation of these systems. This would include improvement of the calculation in the resonance region and extension of the parameter study. (auth)

9473 CREL-698
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
NRX AUTOMATIC CONTROL SYSTEM—GENERAL DESCRIPTION. C. G. Lennox and A. Pearson. Feb. 19, 1957. 16p. (AECL-434). Dep.; $0.50(AECL).

9474 HW-49700
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
COMMENTS ON THE MEASUREMENT OF B_m^2 AND K_∞. David D. Lanning. Apr. 17, 1957. 3p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

It is concluded that for natural U-graphite lattices with $K_\infty \simeq 1.04$, if the Xe effect is ~3%, then K_{eff} must be greater than 1.03 and it would be better to know K_∞ for the design of such a reactor. However, for enriched U reactors or D_2O lattices where $K_\infty \simeq 1.1$, and the Xe effect is ~3%, it would be better to know B_m^2 for the design of the reactor. (T.R.H.)

9475 KAPL-M-SAT-3
Knolls Atomic Power Lab., Schenectady, N. Y.
DIFFUSION BONDING OF SAR, PROTOTYPE INSTRUMENTED FUEL ELEMENT TRANSITION JOINTS. S. A. Toftegaard. Mar. 15, 1957. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Bonds of good quality were produced by arranging joint members in Mo spacing supports and inserting the entire lengths of stainless steel and Zircaloy tubes into a stainless steel tube. The containing tube was then evacuated to 0.05 μ and the joint heated at 1010°C for 30 min. (auth)

9476 KAPL-M-SMS-58
Knolls Atomic Power Lab., Schenectady, N. Y.
THERMAL STRESSES IN LOWER PRESSURIZER WALLS DURING A COLD STARTUP. Sam H. Davis. 22p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A comparison of thermal gradients and stresses in the lower pressurizer walls for cold startup procedures for SAR with and without drainage indicates that a substantial reduction in the membrane stresses can be achieved by choosing the drainage procedure. (T.R.H.)

9477 KAPL-M-SSD-16(Rev. B)
Knolls Atomic Power Lab., Schenectady, N. Y. and [General Dynamics Corp.] Electric Boat Div., Groton, Conn.
S4G SHIP SERVICE ELECTRIC POWER AND CONTROL SYSTEMS; DESIGN DESCRIPTION. E. Kallas and J. A. Walz. May 15, 1957. 77p. Contract W-31-109-Eng-52. $18.30(ph OTS); $6.00(mf OTS).

9478 NAA-SR-1875
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SODIUM GRAPHITE REACTOR QUARTERLY PROGRESS REPORT [FOR] OCTOBER–DECEMBER 1956. R. L. Carter, ed. May 15, 1957. 56p. Contract AT(04-3)-49. $0.35(OTS).

The circular moderator can core studies have been completed and core size recommendations are made. Some early results in the development of the edge loaded moderator can concept are given. Planned SRE low-flux experiments are listed in order. The problem of crystal growth on SRE hot cell windows is being studied. Work on metallurgy and modifications of fuel materials is summarized. The suggested maximum aging temperature (not accompanied by undesirable grain growth) for zirconium is 950°F. Tests on SRE cooling system components are summarized, with emphasis on the cold trap experiment. Control and safety rod tests are described. (M.H.R.)

9479 ORNL-2311
Oak Ridge National Lab., Tenn.
RADIONUCLIDES IN REACTOR COOLING WATER—IDENTIFICATION, SOURCE AND CONTROL. D. W. Moeller. 172p. July 2, 1957. Contract W-7405-eng-26. $1.00(OTS).

A study is presented of reactor cooling systems with emphasis on the recirculating type. The objectives were identification of the radioactive nuclides present in the water at various stages in the system, determination of the source of these nuclides, and measurement of the efficiency of ion exchange beds in their removal. (W.L.H.)

9480 WAPD-170

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. EXPERIMENTAL AND THEORETICAL STUDY OF CRITICAL SLABS. EFFECT OF ABSORBING MEMBRANES OF CADMIUM, GOLD, AND BORON. A. D. Voorhis, T. M. Ryan, M. Goldsmith, and R. T. Jones. Apr. 1957. 43p. Contract AT-11-1-GEN-14. $0.30(OTS).

Experiments are described in which a highly enriched slab core was bisected by absorbing membranes of Cd, Au, and boron–polyethylene. The data included critical core dimensions and activation traverses perpendicular to each membrane. Each assembly was analyzed by use of a one-dimensional, group diffusion, digital code which computed neutron multiplication and flux distribution perpendicular to the membrane. In each calculation the membrane was replaced by an effective diffusion medium having the same thickness. This procedure is described. The results indicated that over 90% of the reactivity worth of the Cd or Au membrane was accounted for in the calculation. The loading in the boron–polyethylene membrane was so small that calculating its reactivity worth by the method used was difficult. (auth)

9481

BURNUP OF FISSIONABLE MATERIAL AND PLUTONIUM PRODUCTION IN URANIUM THERMAL REACTORS. G. Quilico. Energia nucleare (Milan) 4, 115-27(1957) Apr. (In Italian)

On the basis of energetic considerations, a system of differential equations has been developed which characterizes the isotopic composition of irradiated nuclear fuel in a uranium thermal reactor, directly with regard to the power developed per unit of fuel. Considering separately the capture of resonance neutrons and that, in the thermal area, by U-238, the solution of the system is developed for given initial values of the conversion factor and of the enrichment degree of the fuel. It is then shown how practically identical results, as far as numerical calculation is concerned, can be reached with much more simple expressions obtained by adopting some simplifying hypotheses. Diagrams of isotopic composition are given together with other diagrams connected with the power developed separately by the fission of isotopes, calculated by means of elaborated formulas. (auth)

9482

THE HOMOGENEOUS AQUEOUS REACTOR. PART II. I. Wells and D. Newby (A.E.R.E., Harwell). Nuclear Eng. 2, 275-85(1957) July.

The problems which are encountered in homogeneous aqueous reactors are considered, namely, corrosion, handling of slurries, safety, maintenance, methods of fabrication, and gas production and its removal. A typical 2-zone system designed to produce 100 Mw of electricity is described. Reactors with burners and single zone reactors are described with particular reference to the systems of Foster Wheeler and Westinghouse. A list of homogeneous reactors proposed or under construction is given. (T.R.H.)

9483

DOUNREAY. PART II. Nuclear Eng. 2, 286-93(1957) July.

The Dounreay Materials Testing Reactor and Dounreay Fast Reactor, their fuel cycles, chemical separation schemes, fuel element manufacture, effluent disposal, and fuel element examination are described. (T.R.H.)

9484

ANALYTICAL SOLUTION OF MULTIGROUP THEORY FOR REACTOR CALCULATIONS BY THE EXAMPLE FOR TWO GROUPS. A. Ziegler. Z. angew. Phys. 9, 293-301(1957) June. (In German)

9485

THE DIFFUSION OF PROMPT NEUTRONS IN A HOMOGENEOUS THERMAL REACTOR. K. H. Höcker and F. Wagner. Z. angew. Phys. 9, 301-5(1957) June. (In German)

9486

THE IMPORTANCE FUNCTION IN REACTOR KINETICS. H. Grumm and K. H. Höcker. Z. angew Phys. 9, 305-13 (1957) June. (In German)

9487

THE EFFECTIVENESS OF DISCONNECTING RODS OF A THERMAL REACTOR IN REGARD TO THE DIAMETER, NUMBER, AND ARRANGEMENT. W. Häfele. Z. Naturforsch. 12a, 368-77(1957) May. (In German)

NUCLEAR TRANSFORMATION

9488 AEC-tr-2934

COMPUTATION CONCERNING EVENTUAL CONDITIONS OF CHAIN TRANSMUTATION OF URANIUM. Francis Perrin. Translated from Compt. rend. 208, 1394-6(1939). 3p.

The critical radius and mass are computed making various assumptions. A critical mass of 40 tons of U_3O_8 is indicated. (M.H.R.)

9489 AEC-tr-2936

COMPUTATION CONCERNING THE EVENTUAL CHAIN TRANSMUTATION OF URANIUM. Francis Perrin. Translated from Comp. rend. 208, 1573-5(1939). 3p.

Calculations of the critical radius of a uranium mass containing hydrogen and cadmium are given, and it is shown that this radius increases when the temperature rises. (M.H.R.)

9490

ISOMER Pd^{111*}. B. G. Dzantiev, V. N. Levkovskiĭ et. al. (Inst. of Chemical Physics, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 773-6(1957) Apr. 1. (In Russian)

Three Pd activities with half lives of 22 min., 5.5 hr, and 14 hr were observed after neutron bombardment of Cd at 12 Mev. The 22-min. and 14-hr half lives were related to Pd^{111} and Pd^{109} isotopes formed from $Cd^{114}(n,\alpha)Pd^{111}$ and $Cd^{112}(n,\alpha)Pd^{109}$ reactions. Radiochemical separations were made to identify 5.5-hr half life. (R.V.J.)

9491

ANGULAR DISTRIBUTION OF PROTON GROUPS FROM THE REACTION $F^{19}(d,p)F^{20}$. Kazuo Ôno, Junji Shimada, Keiichi Kiroda, and Shigeya Tanaka (Univ. of Tokyo). J. Phys. Soc. Japan 12, 745(1957) June.

The proton angular distribution near angles of zero degree was measured with great precaution, in order to probe the angular distribution characterized by two 1_n values. The angular distribution of protons corresponding to F^{20} in the ground state shows no peak at 0° and a large peak in the backward direction. These results at the bombarding energies of 1.92 and 2.03 Mev indicate that the reaction proceeds mostly by compound nucleus formation. (M.H.R.)

9492

NEUTRON ALPHA PARTICLE ANGULAR CORRELATION IN THE REACTION $^7Li(d,\alpha)$ AND THE GROUND STATE OF ^5He. F. J. M. Farley and R. E. White (Auckland Univ. Coll., New Zealand). Nuclear Phys. 3, 561-70(1957) June.

At a bombarding energy of 160 kev, the reaction $Li^7(d,\alpha)He^5$ is isolated by selecting the corresponding group of monoergic alpha particles with a differential detector and the angular distribution of the coincident neutrons from the disintegration of He^5 is then studied with a scintillation counter. The neutrons are emitted within a cone, and from the distribution through the cone it is deduced that the angular distribution function for the disintegration of He^5 with respect to the direction of emission of the initial alpha particle is $f(\theta) = 1 + A \sin^2\theta$. The results can be fitted for A = 0.72 with the distribution of He^5 excitation energies used by Adair in interpreting data on neutron scattering by He. The dynamics of this experiment are such that the ground state properties predominate in the results for the angular distribution and it is thus confirmed that the ground state has spin $^3/_2$, since a spin of $^1/_2$ would lead to isotropy. (auth)

9493

(n,p) REACTION FOR GOLD. R. A. Peck, Jr. (Brown Univ., Providence, R. I.). Phys. Rev. 106, 965-71(1957) June 1.

An experimental study of the process $Au^{197}(n,p)Pt^{197}$ induced by 14-Mev neutrons, detecting protons in the angular range 10° to 45° with emulsions is reported. Resolution is not adequate for the identification of single excited states, but the energy spectrum does display definite structure and five groups are distinguished, chiefly on the basis of gross differences in their angular distributions. The energy widths of these groups are smaller than expected in view of the target thickness. Positions of angular distribution peaks are utilized for the assignment of angular momentum changes. The corresponding excitations in Pt^{197}, with final angular momentum parameters and total cross sections, are: 0.2 Mev, 2, 8.6 mb; 1.6 Mev, 0 (or 4), 2.2 mb; 2.9 Mev, 5, 2.0 mb; 4.4 Mev, 6, 5.2 mb; 6.0 Mev, 4 (or 0), 2.5 mb. The sum of these cross sections (20.5 mb) is the experimental value for the reaction cross section, since the ground state transition was probably not observed (cross section estimated not over 0.6 mb) and no significant yield of protons was observed corresponding to Pt excitation between the highest listed and the maximum (13 Mev) represented in the spectrum. All cross sections are subject to about 40% uncertainty in neutron flux, but statistical uncertainties are of order 20% or less. Maximum differential cross-sections for the groups, and their locations in the angular distributions, are tabulated. (auth)

9494

STUDY OF $Al^{27}(n,p)Mg^{27}$ AT 14 Mev. R. K. Haling, R. A. Peck, Jr., and H. P. Eubank (Brown Univ., Providence, R. I.). Phys. Rev. 106, 971-4(1957) June 1.

Protons emerging from Al foil bombarded by D + T neutrons have been studied with 400 μ emulsions recording over a continuous range of angles from 15° to 165°. Groups in the composite energy spectrum correspond to known Mg^{27} levels at 1.0 and 3.5 Mev and suggest additional ones at 1.6, 5.7, and 7.0 Mev. The nuclear "temperature" for the continuous portion of the spectrum is 1.2 Mev. The following cross sections are tabulated: for each energy group, isotropic and anisotropic total cross sections and maximum differential cross section; for all protons over 2 Mev, differential cross sections at 30° intervals. The isotropic component greatly exceeds the forward-peaked one for each group. Total cross section for the reaction is estimated to be 79 ± 15 mb. (auth)

9495

INELASTIC PROTON SCATTERING AND (p,d) REACTIONS IN HEAVY ELEMENTS. Bernard L. Cohen and Sigmund W. Masko (Oak Ridge National Lab., Tenn.). Phys. Rev. 106, 995-1000(1957) June 1.

A previous study of anomalous inelastic scattering is extended to include heavy elements, higher excitation energies of the final nucleus, and deuterons from (p,d) reactions. The energy distributions of protons inelastically scattered from each of the principle isotopes of Pb and from Bi are very similar; there are seven relatively well-defined groups with the same energy, cross section, and angular distribution. All elements studied with atomic number above 40 have prominent groups with $E_p - E'_p \cong 2.5$ Mev. The deuteron energy distributions from (p,d) reactions in Bi and Pb isotopes are very similar (five prominent groups with the same energy and similar cross sections) in spite of differing Q values. There are also strong similarities in the deuteron spectra from Au and Pt, and from Pd and Ag. (auth)

9496

INVESTIGATION OF THE GAMMA RADIATION PRODUCED BY IRRADIATING B^{10} WITH PROTONS IN THE ENERGY RANGE 0.7 TO 0.3 Mev. S. E. Hunt, R. A. Pope, and W. W. Evans (Associated Electrical Industries Ltd., Aldermaston, Berkshire, Eng.). Phys. Rev. 106, 1012-15 (1957) June 1.

The proton beams from a pressurized Van de Graaff accelerator were used to irradiate targets of separated B^{10} isotopes, and the γ-ray spectra and yield curves from the $B^{10}(p,\alpha\gamma)Be^7$, $Be^{10}(p,\gamma)C^{11}$ and $B^{10}(p,p'\gamma)B^{10}$ reactions were measured by using a large crystal spectrometer and pulse-height analyzer. The 0.43 ± 0.015 Mev γ ray from the $B^{10}(p,\alpha\gamma)Be^7$ reaction was found to have a resonance at 1.540 ± 0.005 Mev, the cross section at resonance being 80 ± 40 mb. The 9.70 ± 0.15 Mev radiation from the $B^{10}(p,\gamma)C^{11}$ reaction exhibited a single resonance at 1.146 ± 0.005 Mev, the cross section at resonance being measured as 5.5 ± 2 μb. γ rays of about one-twentieth of this intensity of energy about 4.2 and 5.5 Mev can also be attributed to this resonance. The yield of 0.71 ± 0.015 Mev radiation from the $B^{10}(p,p'\gamma)B^{10}$ increased monotonically with energy. The cross section at 2.7 Mev was 11 ± 5 mb. For proton energies of greater than 2.4 Mev, weaker γ rays of energy 1.00 ± 0.04 and 2.12 ± 0.06 Mev were also present. (auth)

PARTICLE ACCELERATORS

9497 AERE-GP/R-2186

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE USE OF PLASMA WAVEGUIDES AS ACCELERATING STRUCTURES IN LINEAR ACCELERATORS. L. B. Mullett. Feb. 1957. 34p.

Propagation of radio-frequency waves on plasma rods, with phase velocity less than or equal to the velocity of light, is discussed in relationship to linear accelerators. Conditions are obtained for the achievement of simultaneous phase and radial stability for the accelerated particles. (auth)

9498 MURA-263

Midwestern Universities Research Assn., Madison, Wis.

CONCERNING COUPLING RESONANCES IN THE SPIRALLY-RIDGED FFAG ACCELERATOR. L. Jackson Laslett and A. N. Sessler. May 6, 1957. 72p. Contract AT(11-1)-384. $12.30(ph OTS); $4.50(mf OTS).

Theoretical and computational results are presented to illustrate the behavior of particle motion in spirally-ridged FFAG accelerators when operated in the neighborhood of the $\sigma_x = 2\sigma_y$, $\sigma_x = \sigma_y$, $\sigma_x = 2\sigma_y = 2\pi$, and $2\sigma_x + 2\sigma_y = 2\pi$ resonances. Save for the second of these resonances, the computational examples pertain to structures with parameters characteristic of models (N = 5). The exponential growth of y-amplitude which may be observed

to occur over many orders of magnitude when operating near these resonances is generally concordant, semi-quantitatively, with the results of a theoretical treatment in which the equation for axial motion is treated as linear and the radial motion independently prescribed. (auth)

9499 MURA-295
Midwestern Universities Research Assn., Madison, Wis. COMPUTATIONAL EXAMPLES OF SOLUTIONS TO DIFFERENTIAL EQUATIONS WHICH SIMULATE GROWTH OF AXIAL OSCILLATIONS IN AN FFAG ACCELERATOR OPERATED NEAR THE $\sigma_x = 2\ \sigma_y$ RESONANCE. L. Jackson Laslett. June 7, 1957. 32p. Contract AT(11-1)-384. $6.30(ph OTS); $3.00(mf OTS).

The effect of various coupling terms upon the ψ-growth phenomenon for an operating point near the $\sigma_p = 2\ \sigma_\psi$ resonance is examined computationally. Results are presented in tabular form and graphically. A tentative discussion of the results is also given. (auth)

9500
RADIATION EFFECTS ON FREE OSCILLATIONS IN SYNCHROTRONS. Irvin G. Henry (California Inst. of Tech., Pasadena). Phys. Rev. 106, 1057-61(1957) June 1.

Expressions are found for radial and vertical free-oscillation amplitudes in synchrotrons taking particular account of the radiation emission. In strong-focusing electron synchrotrons the radial oscillation may become undamped unless corrective measures are taken. (auth)

RADIATION ABSORPTION AND SCATTERING

9501
SCATTERING OF LOW-ENERGY H^- IONS IN HELIUM, NEON, AND ARGON. T. L. Bailey, C. J. May, and E. E. Muschlitz, Jr. (Univ. of Florida, Gainesville). J. Chem. Phys. 26, 1446-51(1957) June.

Elastic and inelastic cross sections have been measured for the scattering of H^- ions in He, Ne, and A gases at incident ion energies in the range 5 to 350 ev. One term interaction potentials of the form $V = -K/r^n$ were calculated from the low-energy elastic cross sections. The observed inelastic cross sections are interpreted as cross sections for electron detachment from H^-; they show a similar behavior with ion energy W in the three cases, appearing at W between 0 and 5 ev, rising rapidly to W = 40 ev, and then rising very slowly to W = 350 ev. Evidence was found for positive ion formation in H^- collisions with Ne and A atoms at ion energies above 100 ev. (auth)

9502
STUDY OF THE SCINTILLATION PROCESS. E. R. Hardwick (Stanford Univ., Calif.) and W. G. McMillan (Univ. of California, Los Angeles and Rand Corp., Santa Monica, Calif.). J. Chem. Phys. 26, 1463-71(1957) June.

A phenomenological time-dependent relation between phosphor concentration and emission intensity, including effects of self-absorption, is derived for scintillation solutions. The dependence of the integrated intensity equation on concentration of phosphor and quencher is tested experimentally in several ways using α irradiation, and found to give agreement within the (occasionally large) experimental error. Application of this equation to measurements of the decline in scintillation efficiency of anthracene crystals on bombardment with α particles suggests a method of obtaining the effective exciton "range," for which we estimate ~ 3000 A as a lower limit. The question of the mechanism of energy transfer is discussed, and some photographic data are presented which indicate that the large (~ 1 mm) transfer distances in similar experiments may have been due to phosphor photon absorption and re-emission. (auth)

9503
A STUDY OF THE DIFFUSION OF 3.8 Mev TRITONS BY PROTONS CONTAINED IN A PHOTOGRAPHIC PLATE. CURVES GIVING THE EFFECTIVE CROSS-SECTION IN THE SYSTEM OF THE CENTER OF GRAVITY AS A FUNCTION OF THE ANGLE OF DIFFUSION AND THE ENERGY. G. Baumann. J. phys. radium 18, 337-44 (1957) May. (In French)

9504
PHOTON SELF-ABSORPTION AND SCATTERING BY THE 15.1-Mev LEVEL IN C^{12}. Evans Hayward and E. G. Fuller (National Bureau of Standards, Washington). Phys. Rev. 106, 991-5(1957) June 1.

Bremsstrahlung x rays have been used to excite the 15.1-Mev level in C^{12}. The integral scattering cross section of 19.0 ± 0.27 Mev mb has been determined by measuring the absolute number by 15.1 Mev x-rays scattered. The peak absorption cross section 22.2 ± 2.2 b has been obtained from a self-absorption experiment. These results combine to give 54.5 ± 9.3 ev for the ground state radiation width and 79 ± 16 ev for the total width of the level. (auth)

9505
PHOTON SCATTERING FROM PROTONS AND DEUTERONS. R. H. Capps (Univ. of California, Berkeley). Phys. Rev. 106, 1031-42(1957) June 1.

The scattering of photons of 100 to 200 Mev from protons and deuterons is examined in a model in which it is assumed that only electric and magnetic dipole photons scatter. Two dispersion relations derived by Gell-Mann, Goldberger, and Thirring, and the analysis of photopion production from nucleons by Watson, Keck, Tollestrop, and Walker, are used to guide the theoretical prediction of differential scattering cross sections. Several approximations are made, including the impulse approximation in the discussion of photon-deuteron scattering; the accuracy of these approximations is estimated. In this model the photon-proton cross section, and the sum of the elastic and inelastic photon-deuteron cross sections are largest at backward scattering angles. Several feasible types of photon-deuteron scattering experiments are discussed briefly. (auth)

RADIATION EFFECTS

9506
ON THE DISORDERING MECHANISM BY α PARTICLES IN GERMANIUM. A. Ascoli, M. Asdente, and E. Germagnoli (CISE Labs., Milano). Energia nucleare (Milan) 4, 131-8 (1957) Apr.

Changes in electrical conductivity due to α-particle irradiation of n-type Ge are considered. From these measurements the number of carriers removed from the conduction band is deduced and information is obtained concerning the spectrum of electron levels which are introduced within the gap. (auth)

9507
EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF SOME STRUCTURAL STEELS. E. E. Baldwin (Knolls Atomic Power Lab., Schenectady, N. Y.). Welding J. (N. Y.) 36, 342-s-7-s(1957) July.

Tensile and impact specimens of ASTM A302B steel were irradiated at 500 and 700° F to integrated fast fluxes of 3.8×10^{18} nvt. Notched-bend specimens of ASTM A201 steel were irradiated at 300 to 400° F to integrated fast fluxes of 4.3×10^{20}. Results indicated little or no change in properties of the A302, but substantial increases in strength and loss of ductility and energy absorption ability of the A201. Substantial recovery of the A201 damage could be accomplished by annealing at 600° F. (auth)

RADIOACTIVITY

9508 NYO-4859

New York Operations Office. Health and Safety Lab., AEC. METHOD OF CALCULATING INFINITY GAMMA DOSE FROM BETA MEASUREMENTS ON GUMMED FILM. Naomi A. Hallden and John H. Harley. Apr. 15, 1957. 37p. $0.30(OTS).

Since it is not possible to make a direct measurement of the γ dose resulting from normal fall-out away from the test site, calculations are outlined which allow an estimate of γ dose based on the measurement of β activity in fall-out. (B.J.H.)

9509

HALF-LIVES OF ISOMERIC STATES IN Pb^{202}, Pb^{203}, Pb^{206} AND Tl^{202}. Björn Aström (Nobel Inst. of Physics, Stockholm, Sweden). Arkiv Fysik 12, No. 3, 237-45 (1957).

The isomeric transitions in Pb^{202} (E4, E5), Pb^{203} (M4), Pb^{206} (E3) and Tl^{202} (E3) are associated with high-multipolarities. The half lives of Pb^{202m} and Pb^{203m} were accurately measured by means of an automatic recording arrangement. In the case of Pb^{206m} and Tl^{202m} a modified delayed-coincidence technique was used. The following half lives were found: Pb^{202m}: 3.62 ± 0.03 hours, Pb^{203m}: 6.09 ± 0.10 sec, Pb^{206m}: 128 ± 5 μsec, and Tl^{202m}: 600 ± 200 μsec. (auth)

9510

A LABORATORY Co^{60} SOURCE OF 60 CURIES. Ivan G. Draganić, Branislav V. Radosavljević, and Nada J. Milašin. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 7, 151-6(1957) Mar.

A description is given for an economical laboratory source of 60 curies of radioactive cobalt. Dose rates achieved are 4×10^{18} ev/ml/hour (1 ml irradiated volume) and 23.5×10^{18} ev/ml/hour (10 ml irradiated volume). The dependence of absorbed dose on the height of irradiated layer in the sample is studied. Isodose regions are given for different conditions usually occurring during the work with the source, placed in a lead block and situated in the floor of the laboratory. (auth)

9511

THE EXCITED STATES OF C^{13}. Radha Raman Roy, Alphonse Lagasee, Marie-Louise Goes, Rahim Achari, and Andre de Henau. Compt. rend. 244, 2907-9(1957) June 12. (In French)

The excited states of C^{13} have been determined by the study of the reaction $B^{10}(\alpha,p)C^{13}$. In addition to the known levels, five new levels were observed. (auth)

9512

BETA INTERACTION IN THE DECAY OF Cs^{137}. Toshio Katoh, Masao Nozawa, and Yasukazu Yoshizawa (Osaka Univ.) and Yujiro Koh (Osaka City Univ.). J. Phys. Soc. Japan 12, 738(1957) June.

An attempt was made to determine the sign of the ratio of G_s/G_t in the beta interaction by investigating the higher component of beta rays from Cs^{137}. (M.H.R.)

9513

THE ISOMERIC TRANSITIONS IN Tl^{197} AND Tl^{195}. G. Andersson, P. A. Tove, B. Jung, and I. B. Svensson (Univ. of Uppsala). Nuclear Phys. 3, 493-505(1957) June.

Internal conversion electrons from the isomeric transitions in Tl^{197} and Tl^{195} have been studied in high resolution β spectrometers. The intensity ratios of the lines, when compared with recent theoretical values, were found to confirm the multipole assignment E3 for both transitions. The γ energies were established as 222.45 ± 0.05 kev (Tl^{197m}) and 99.1 ± 0.1 kev (Tl^{195m}). The half lives of Tl^{197m} and Tl^{195m} have been measured as 0.55 ± 0.10 sec and 3.5 ± 0.4 sec, respectively, using rapid chemical techniques and a multichannel method of time analysis. Pulse height spectra of the short-lived activities were found to support the mass assignments. (auth)

9514

NOTE ON THE DECAY OF Tl^{198m}. G. Andersson (Gustaf Werner Inst. for Nuclear Chemistry, Uppsala) and I. Bergstrom (Nobel Inst. of Physics, Stockholm). Nuclear Phys. 3, 506-12(1957) June.

The energies and intensities of the conversion electrons of the 48 kev γ ray emitted in the decay of 1.75 h Tl^{198m} have been measured in a high resolution spectrometer. The 48 kev γ ray is converted in Hg, which leads to a revised level scheme of Tl^{198}, the levels being 7+ (543.1 kev) 3− (282.4 kev) and 2− (0 kev). The relative conversion intensities in the L and M subshells, respectively, agree perfectly with those obtained from the E2 conversion coefficients by Rose et al. (auth)

9515

LEVELS IN Pb^{202} AND Tl^{202} POPULATED FROM 3.62-h Pb^{202m}. J. A. McDonell, R. Stockendal, C. J. Herrlander, and I. Bergstrom (Nobel Inst. of Physics, Stockholm). Nuclear Phys. 3, 513-40(1957) June.

Using beta spectroscopic techniques, conversion electrons of transitions following the decay of 3.62-hr Pb^{202m} have been investigated. The previously suggested level sequence in Pb^{202} is unambiguously supported by results: 0+ (0 kev), 2+ (961.4 kev), 4+ (1383.5 kev), 5− (2041.1 kev) and 9− (2170.7 kev). From the 9− state two gamma rays of multipolarity E4 (129.3 kev) and E5 (787.2 kev) are emitted. In addition, a very weak E5 transition of energy 547.2 kev between the 9− state and a second 4+ state (1623.8 kev) was observed, as well as an M1 transition of energy 240.3 kev between the two 4+ states. The succession of the 422.1 kev and 961.4 kev transitions was determined by comparing their relative intensities in the decay of Pb^{202m} and Bi^{202}. Except for the 5− level, the similarity between levels in Pb^{202} and Pb^{204} is very striking. The 9− state in Pb^{202} was found to be de-excited also by electron capture (9.7%) to levels in Tl^{202}. The following level sequence is suggested for the Tl branch: 2− (0 kev), 4− (490.4 kev), 7+ (950.2 kev), 6+ (1099.1 kev) and 8+ (1340.1 kev). The 8+ state is de-excited by an M1 transition of energy 389.9 kev, and also by a 241.1 kev E2 transition followed by a 148.9 kev M1 transition. The isomeric 7+ state is de-excited by a 459.8 kev E3 transition and a 490.4 kev E2 transition in cascade. The succession of the 389.9, 459.8 and 490.4 kev transitions is suggested from coincidence measurements. A gamma ray of energy 335.6 kev and multipolarity M1 (?) may be emitted from an 8+ or 9+ (1675.7 kev) level to the 8+ (1340.1 kev) level. In addition, some weak conversion lines were found, to which no definite assignment could be given. (auth)

9516

NEW HALF-LIFE IN THE FAMILY OF ANTIMONY ISOTOPES. H. Bosch and H. Munczek (Comisión de Energía Atómica, Buenos Aires, Argentina). Phys. Rev. 106, 983-5 (1957) June 1.

By using scintillation techniques in analyzing the γ radiation following the β decay of a fission-product antimony sample, evidence of a new half life of 149 ± 4 hours was found in the family of antimony isotopes. (auth)

9517

INTERNAL BREMSSTRAHLUNG AND DECAY SCHEME OF Sb^{119}. J. L. Olsen, L. G. Mann, and M. Lindner (Univ. of California, Livermore). Phys. Rev. 106, 985-90(1957) June 1.

The spectrum and yield of internal bremsstrahlung accompanying electron capture from S and P states in Sb^{119}

were measured and compared with the theory of Glauber and Martin. Sb^{119} was obtained as the daughter from Te^{119} produced by the Sb(d,xn)Te^{119} and Sn(α,xn)Te^{119} reactions. The decay is by orbital electron capture to the 23.83-kev state in Sn^{119}. The following results were obtained: Sb^{119} half life, 38.0 hr; Sb^{119}–Sn^{119} decay energy, 579 ± 20 kev; half life of the 23.83-kev state and its total conversion coefficient, $(1.85 \pm 0.1) \times 10^{-8}$ sec and 6.3 ± 0.4, respectively. The intensity of internal bremsstrahlung for capture from S states was $(1.06 \pm 0.15) \times 10^{-4}$ quanta/K capture. This agrees with the theoretical prediction of 0.97 ± 10^{-4}. The large contribution at low energies from P-state capture was measured down to 70 kev and agrees with the theory in its present state of completion. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

9518

ISOMERIC TRANSITIONS IN THE RARE-EARTH ELEMENTS. C. L. Hammer and M. G. Stewart (Iowa State Coll., Ames). Phys. Rev. 106, 1001-7(1957) June 1.

A search was made for isomeric transitions in the rare-earth elements with half lives greater than 5 μ and less than ~30 min which arise in the decay of photoexcited nuclei. Four isomeric transitions were found and identified as follows: Tb^{158}, 50 kev <E<200 kev, 11.0 ± 0.1 sec, M3 or E3; Ho^{163}, 305 kev, 0.8 ± 0.1 sec, E3; $Er^{165, 167, \text{ or } 169}$, 213 kev, 2.5 ± 0.1 sec, E3; Lu^{174}, 133 kev, 75 ± 2 μsec, E2. These results are compared with the predictions of the nuclear models which have been proposed by Nilsson and Gottfried. (auth)

9519

THE AGGREGATION OF MICROQUANTITIES OF RADIOELEMENTS IN THE LIQUID AND SOLID PHASES. I. E. Starik. Uspekhi Khim. 26, 389-98(1957) Apr. (In Russian)

Concentrations of microquantities of radioelements in liquid phases were studied by investigating the colloidal and adsorptive properties of Po. The constitution of radioelements formed in solid phases from mother substances were studied by leaching Ra, U, Th, and ThX. (R.V.J.)

9520

DETERMINATION OF THE HEAT OF PHASE TRANSFORMATION OF CERIUM UNDER PRESSURE. M. G. Gonikberg, G. P. Shakhovskoĭ, and V. P. Butuzov (Moscow Inst. of Crystallography). Zhur. Fiz. Khim. 31, 350-3(1957) Feb. (In Russian)

The heat of the phase transformation in Ce at 13 to 18°C and pressure of ~ 7000 kg/cm^2 has been thermographically determined as 880 ± 40 cal/(g. atom) which confirms the identity of modification of Ce formed under pressure with low-temperature modification. (tr-auth)

THEORETICAL PHYSICS

9521

ON THE RELATION BETWEEN SCATTERING PHASE AND BOUND STATES. J. M. Jauch (State Univ. of Iowa, Iowa City). Helv. Phys. Acta 30, No. 2-3, 143-56(1957).

The relation between phase shifts and bound states proved by Levinson for spherical symmetric potential functions satisfying certain regularity conditions is generalized for arbitrary interactions. The regularity condition of Levinson is replaced by a condition for the behavior of the scattering state wave functions at infinite energy. The proof of the relation given here shows that it is a simple consequence of the orthogonality and completeness relation for the eigenfunctions of the total energy operator. (auth)

9522

THEORY OF RADIATION OF PHOTONS OF ARBITARILY SMALL MASS. E. C. G. Stueckelberg. Helv. Phys. Acta 30, No. 2-3, 209-15(1957).

If the photon has a mass $\hbar\mu \pm 0$, a canonical transformation yields a Hamiltonian containing the energies of the charged field (including the Yukawa potential energy); of the transversal and longitudinal photons, and an interaction term. The interaction term between charge and longitudinal photons is smaller than the transversal term by a factor μ/ω, if $\hbar\omega$ is the photon energy. Thus the limit $\mu \to 0$, which replaces the Yukawa potential by the Coulomb potential, is possible. The longitudinal photons, presenting no interaction, can pass freely through the walls of a cavity and Planck's radiation law holds. The necessary and sufficient condition for this result is the continuity equation for electric charge. (auth)

9523

THE ROLE OF THE ATOMIC EFFECTIVE CROSS SECTIONS IN SPECTRA EXCITATIONS. S. E. Frish. Uspekhi Fiz. Nauk 61, 461-90(1957) Apr. (In Russian)

The effective cross sections are described for the atomic transitions from the lower to higher levels occurring with the first or second type of electronic, atomic, or ionic impact processes or from the absorption of photons. The effective cross section value $O_{ik} = P_{ik} Q_0$ depends not only on the type of the colliding particles but also on the speed with which they move toward each other. In order to find the effective cross sections of impacts inducing the atomic excitation, studies were made of the processes determining the intensity of spectral lines. Effective cross sections were determined by the electronic impact method, and experimental observations were made of cascade transitions. The role of effective cross sections in the excitation of spectral lines in gas discharge plasma, the excitation of resonance lines, the stepped excitations, and the effective cross sections of second-type impact were studied. (R.V.J.)

9524

MENDELEEV'S PERIODIC SYSTEM AND MODERN DEVELOPMENT OF PHYSICS AND CHEMISTRY. V. K. Semenchenko. Zhur. Fiz. Khim. 31, 273-82(1957) Feb. (In Russian)

URANIUM AND URANIUM COMPOUNDS

9525

HALF LIFE AND DECAY SCHEME OF U^{235}. E. Wurger, K. P. Meyer, and P. Huber. Helv. Phys. Acta 30, No. 2-3, 157-82(1957). (In German)

The half life of U^{235} with respect to alpha decay was measured by comparison of its alpha activity with the U^{238} and U^{234} activities of a source of natural uranium. As only one alpha group of the U^{235} alpha spectrum can be measured without interference from the other uranium isotopes, some knowledge of the U^{235} decay scheme is necessary for the calculation of its half life. Consequently the decay scheme of U^{235}, proposed by Ghiorso, has been tested and verified in a scintillation spectrometer by $\alpha-\gamma$ coincidences. Furthermore the conversion of the two γ rays has been measured. The value of $6.84 \pm 0.15 \times 10^8$ years found for the half life of U^{235} is in agreement with the value of $7.13 \pm 0.16 \times 10^8$ years found by absolute activity measurement. (auth)

9526

THE SPIN OF U^{235} AND RATIOS OF NUCLEAR MOMENTS OF U^{235} AND U^{233}. Jean Blaise, Simon Gerstenkorn, and Michèle Louvegnies. J. phys. radium 18, 318-19(1957) May. (In French)

PATENTS

CHEMISTRY

9527

METHOD OF LITHIUM EXTRACTION. G. G. Collins, D. S. Taylor, and P. J. O'Brien (to Borax Consolidated, Ltd.). British Patent 770,812. Nuclear Eng. 2, 306(1957) July.

Extraction of Li values from silicate ores (petalite, lepidolite, spodumene) by roasting at 450 to 700°C with the addition of reactants, one of which is preferably sodium nitrate or hydroxide; the other reactants being a carbonate, sulfate, oxide or hydroxide of an alkali metal (not lithium) or of an alkaline earth metal, followed by leaching with an aqueous medium. (auth)

9528

SEPARATION OF PHOSPHORUS. A. H. Booth (to U. S. Atomic Energy Commission). U. S. Patent 2,552,032. May 8, 1951.

A method for the recovery of P^{32} from an irradiated sulfur mass is described. The irradiated S is heated with an acetic acid-acetic anhydride mixture. The P is extracted into the acid mixture while the S is substantially unaffected. The acetic acid extractant is then evaporated to dryness, and the P, now in the form of acids of phosphorus, is recovered from the dry residue by leaching with dilute HCl. (auth)

9529

RECOVERY OF RADIOACTIVE PHOSPHORUS FROM NEUTRON IRRADIATED SULFUR. J. G. MacHutchin and La Verne C. Watson (to U. S. Atomic Energy Commission). U. S. Patent 2,621,110. Dec. 9, 1952.

A method is described for the recovery of P^{35} from an irradiated sulfur mass. The irradiated S is heated with a mixture of an organic solvent, and an aqueous acid which does not react with either the solvent or the S. The S is extracted into the solvent while the P^{35} remains dissolved in the aqueous phase, from which it may be recovered. Mentioned as suitable organic solvents are C_2HCl_3, CS_2, and $C_2H_2Br_4$. (auth)

9530

PRECIPITATION OF VANADIUM OXIDES. J. Halpern and F. A. Forward (to U. S. Atomic Energy Commission). U. S. Patent 2,665,970. Jan. 12, 1954.

A method for the recovery of V^{5+} from basic or neutral solutions is given. The solution is treated with gaseous molecular hydrogen, under pressure, and in the presence of a Ni or Pt hydrogenation catalyst. The H_2 reduces the V to a lower valent state, in which form it is insoluble in the solution, and the V then precipitates and is separated. (auth)

9531

PRECIPITATION OF URANIUM FROM ALKALI METAL CARBONATE SOLUTIONS. F. A. Forward and J. Halpern (to U. S. Atomic Energy Commission). U. S. Patent 2,727,806. Dec. 20, 1955.

A method is given for the separation of U^{6+} from carbonate leach solutions. In order to effect this separation, the U is reduced to the U^{4+}, which is insoluble in such carbonate leach solutions. This reduction is accomplished by heating the solution with molecular hydrogen gas under pressure and at the same time contacting the solution with a Ni or Pt hydrogenation catalyst. (auth)

9532

METHOD FOR RECOVERING BORON VALUES. M. Kilpatrick (to U. S. Atomic Energy Commission). U. S. Patent 2,787,527. Apr. 2, 1957.

A method is described for recovering boron values from the liquid by-product arising from the condensation of various fragments formed during the decomposition of BF_3 complex. This liquid by-product is reacted with HF and with alkali to form an alkali fluoborate. The fluoborate is separated from the reaction mixture and decomposed by treatment with H_2SO_4 to liberate BF_3. (auth)

9533

METHOD FOR DETERMINING BORON FLUORIDE ETHER COMPLEX IN A COMPOSITION. W. A. Winsten and I. Kirshenbaum (to U. S. Atomic Energy Commission). U. S. Patent 2,787,529. Apr. 2, 1957.

An analytical method for determining the quantity of boron fluoride-ether complex present in a composition is given. The complex is decomposed by the action of H_2O and a soluble salt such as an alkali metal halide, nitrate or sulfate, in such a way that the decomposition products containing B and F are not volatile, while the ether is volatile and escapes. The difference in weight between the products and reactants yields the weight of ether liberated, and from this the amount of complex originally present may be calculated. (auth)

9534

PROTACTINIUM EXTRACTION PROCESS. D. F. Peppard (to U. S. Atomic Energy Commission). U. S. Patent 2,789,878. Apr. 23, 1957.

A method for the recovery of Pa from aqueous solutions is given, and its separation from U and Th is described. This separation is effected by organic solvent extraction using an alkyl phosphate, preferably TBP. Acidity of the aqueous solution is manipulated in order to separate the Pa, Th, and U singly and in combination, and salting out agents are used. (auth)

9535

RECOVERY OF URANIUM FROM PHOSPHORIC ACID. D. Kaufman (to U. S. Atomic Energy Commission). U. S. Patent 2,789,879. Apr. 23, 1957.

A method is given for obtaining U from phosphate rock, or, more specifically, from the phosphoric acid into which the rock is converted in the course of fertilizer manufacture. The phosphoric acid is first treated with a reducing agent, such as Fe, so as to obtain the U in the uranous form. Ammonia is added at this point to produce soluble monoammonium phosphate fertilizer, but the NH_3 also precipitates the U values. This precipitate can then be separated and its U content upgraded by customary techniques. (auth)

9536

METHOD OF PREPARING PURE BORIC OXIDE. C. J. Rodden and Allan R. Eberle (to U. S. Atomic Energy Commission). U. S. Patent 2,789,884. Apr. 23, 1957.

A method of recovering pure B_2O_3 from a $(CH_3)_2O-BF_3$ complex is discussed. The process may be carried out by adding the boron complex material to water, boiling to volatilize the ether, and adding granular $CaCO_3$ to the ether free solution. The solution is then boiled and filtered and H_3BO_3 recovered by evaporating the filtrate. The H_3BO_3 so formed is then ignited to the oxide. (auth)

9537

MAGNESIUM REDUCTION PROCESS FOR PRODUCTION OF URANIUM. Charles B. Sawyer and Bengt R. F. Kjellgren (to U. S. Atomic Energy Commission). U. S. Patent 2,789,897. Apr. 23, 1957.

A method is given for the production of massive U metal. The metal is produced by reacting UF_4 with Mg. Although this reaction is exothermic, the heat generated is insufficient to make the U fluid enough to coalesce in massive form. To remedy this, heating of the reaction vessel is continued until after the reaction is complete. The temper-

ature should be maintained above 1125°C, the m.p. of U. (auth)

9538

PROCESS OF RECOVERING URANIUM. M. D. Kamen (to U. S. Atomic Energy Commission). U. S. Patent 2,790,701. Apr. 30, 1957.

A process is presented for the securing of U values from deposits formed on stainless steel parts of a calutron isotope separator. The deposits are dissolved and the U is accompanied into solution by varying amounts of Fe, Cr, and Ni. This wash solution is treated with NH_3 which precipitates U, Fe and Cr away from any Ni present. The precipitate is collected and dissolved in HCl, and the resulting solution extracted with ether to extract the Fe into the ether and away from the U and Cr. The HCl solution is then heated to drive off chlorides, and HNO_3 is added to convert the U and Cr to nitrates. This HNO_3 solution is then contacted with ether to extract the U away from the Cr, and the ether extract is then separated and the U recovered therefrom. (auth)

9539

RECOVERY OF RUTHENIUM FROM AQUEOUS SOLUTIONS. H. R. Schmidt and R. L. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,792,412. May 14, 1957.

A method for the separation of Ru from solutions of irradiated U is given. The Ru present may be precipitated by the addition of a quantity of an organic sulfo-compound, and the precipitate so formed is stable to temperature and acidity change. Mentioned as suitable precipitating agents are mercaptans, thioethers and disulfides. (auth)

9540

REMOVAL OF MATERIAL FROM PROCESSING TANKS. D. S. Webster (to U. S. Atomic Energy Commission). U. S. Patent 2,793,753. May 28, 1957.

A method for remote control removal of radioactive fission products from solutions is given. The solution is run over an ion exchange resin whereby the fission products are adsorbed. The adsorbate is first treated with an eluting agent specific to Pu, whereby the Pu is desorbed and separated, while the fission products remain on the resin. The resin is then removed from the containing vessel by means of a gas or vapor lift, a fresh supply of resin is introduced, and the process repeated. (auth)

ENGINEERING

9541

PUMP. A. A. Abatiello (to U. S. Atomic Energy Commission). U. S. Patent 2,791,372. May 7, 1957.

A pump is described which has an improved sealing means to better protect the working parts from the corrosive material being pumped, and to prevent contamination of the pumped material. This is accomplished by equalizing the pressure on each side of the seal. A piston and cylinder which pumps the corrosive material is enclosed by a bellows. A second piston, connected by a scotch yoke to the first piston, controls the air pressure on the outside of the bellows so that equal pressure exists across the seal at all times. The second piston also causes the moving parts to be lubricated. The arrangement virtually eliminates leakage to or from the working pump. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

9542

PROCESS FOR MELTING AND REFINING URANIUM. F. H. Spedding and H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,787,536. Apr. 2, 1957.

A process for melting and casting U without contaminating it with crucible material is described. The metal is melted in a graphite container, but the temperature is not allowed to go above 1650°C. In this manner the UC, which forms by reaction of the U with the crucible walls, is prevented from dissolving in the U and is retained upon its surface as a skin from which the pure U metal may be easily separated. (auth)

9543

METHOD OF PRODUCING METAL. H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,787,537. Apr. 2, 1957.

A method is given for tapping liquid U from the reduction vessel in which it is produced. The U is tapped immediately after the reaction has subsided so that the U will still be molten and to take advantage of the pressure within the reduction bomb. The actual tapping apparatus consists of a group of valves including one built into the bottom of the reduction crucible itself. These valves are opened by lowering the bomb onto the tapping apparatus. (auth)

9544

PRODUCTION OF URANIUM. F. H. Spedding, H. A. Wilhelm, and W. H. Keller (to U. S. Atomic Energy Commision). U. S. Patent 2,787,538. Apr. 2, 1957.

A method for the production of massive U metal is described. The metal is produced by reacting UF_4 with Mg. Although this reaction is exothermic, the heat generated is insufficient to make the U fluid enough to coalesce in massive form. To remedy this, additional heat is obtained from a simultaneous auxiliary exothermic reaction. The reaction may be between additional Mg and an oxidant added to the reaction mass and the particular oxidant claimed by this patent is molecular iodine. (auth)

9545

HEAT TREATED URANIUM ALLOY AND METHOD OF PREPARING SAME. D. W. White, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,789,072. Apr. 16, 1957.

A process is given for obtaining U alloys which are dimensionally stable when subjected to nuclear irradiation. This is accomplished by adding to the U from 0.1 to 10 at. % Cr, heating the alloy so obtained to a temperature above the alpha-beta transformation temperature and then quenching the alloy to alpha-phase and holding the alloy at this temperature until transformation to alpha phase crystals is complete. (auth)

PHYSICS

9546

GAMMA-RAY DETECTORS. (to Texaco Development Corp. (U.S.A.).) British Patent 770,857. Nuclear Eng. 2, 306(1957) July.

The conventional Geiger-Mueller counter can be made more efficient by filling with a mixture of the rare gases but there remains still the "dead time", i.e., the time interval during which the counter is insensitive after recording a count. The length of the dead time becomes very important where a high intensity of gamma rays is to be measured. A detector of the multi-cathode plate type is 5 to 10 times more efficient than the conventional counter. Its dead time with a filling of a mixture of A and anhydrous NH_3 is about 100 μsec. This time can be reduced as much as 50% by a filling of a mixture of A (19.9 to 65%), He (25 to 80%) and a small proportion of anhydrous NH_3 (0.1 to 10%). The more He is present, the shorter will be the dead time up to an optimum of 77% He, 20% A, and 3% anhydrous NH_3. (auth)

9547

NUCLEAR REACTOR. S. G. Bauer (to U. K. Atomic Energy Authority). British Patent 771,111. Nuclear Eng. 2, 306(1957) July.

In order to eliminate structural and sheath materials of large neutron-absorbing properties, the fissile material is disposed as extended films or layers sandwiched between pairs of plates of moderator material. The moderator envelope of the fissile material may be in the form of troughed or ribbed sheets to provide channels for coolant fluid between adjacent elements. Fissile material such as plutonium can easily be completely enclosed as a film or coating. When fertile material (thorium or natural uranium or an oxide thereof) is included, somewhat thicker layers may be necessary and the moderator plates will then be shaped or packed accordingly to contact each other along their peripheries. (auth)

9548

HIGH-VOLTAGE MACHINES FOR THE PRODUCTION OF HIGH-SPEED ELECTRICALLY-CHARGED PARTICLES. (to Emil Haefely and Cie. A. G. (Switzerland).) British Patent 771,222. Nuclear Eng. 2, 306(1957) July.

The control of high voltages in ranges higher than 1 MV bristles with difficulties and at over 4 MV becomes nearly impossible. By accommodating the high-voltage generator in a pressure vessel filled with compressed gas, the size of the high-tension machine can be reduced. Repairs, however, of the generator remain difficult although they can be facilitated by lowering the generator into the ground in such arrangement that the electrically charged particles are accelerated vertically so that they are then available in the laboratory above the generator. The caisson vessel acting as counter-electrode would have to be carefully machined and polished inside. Alternatively, a thin metal screen may be suspended in the caisson. (auth)

9549

COINCIDENCE CIRCUIT. R. E. Bell (to U. S. Atomic Energy Commission). U. S. Patent 2,610,303. Sept. 9, 1952.

Described here is a dual coincidence circuit for determining the time correlation between pairs of pulses wherein the resolving time is very short. A reduction in the resolving time of prior art coincident circuits was limited due to pre-selection and pre-treating of the incoming pulse before reaching the actual coincidence determining elements. This circuit alleviates the above difficulty by accomplishing the pulse height selection after coincidence determination. (auth)

9550

DISCRIMINATOR CIRCUIT. W. J. Battell, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,673,294. Mar. 23, 1954.

A discriminator circuit is described in which the discriminating level is maintained substantially exact irrespective of the component variations and minor supply voltage changes inherent in discriminator circuits. A first unilateral conduction means is connected to provide discrimination at a level set by a voltage derived from a potentiometer through a second unilateral conduction means. The current which determines the point of discrimination is supplied by a power supply which is floating with respect to the voltage supplied by the potentiometer. (auth)

9551

ELECTROSCOPE. H. Carmichael, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,677,773. May 4, 1954.

A description is given of an improved electroscope construction incorporating an indicator fiber consisting of a fine, elastic electrical conductor supported with an extremity free to deflect under the influence of an applied electrostatic field. The indicator which is small in size, simple in construction, and of a rugged design is principally intended for use by individuals to effect continuous measurement of radioactive radiation to which they are exposed. (auth)

9552

DISCRIMINATOR CIRCUIT. N. F. Moody (to U. S. Atomic Energy Commission). U. S. Patent 2,683,806. July 13, 1954.

A voltage discriminator circuit of the trigger type is described which provides an output pulse of a predetermined magnitude for each input pulse which exceeds a predetermined voltage level. The invention overcomes the instability and the lack of sensitivity found in previously known triggered discriminator circuits, when used for very fast pulses requiring a high resolving power, by providing a circuit in which both tubes are conducting with initially high loop gain, the circuit being stabilized by means of a negative feedback path which is removed upon triggering of the circuit. (auth)

9553

ELECTRONIC COUNTER. N. F. Moody, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,691,100. Oct. 5, 1954.

In the pulse shaping circuit in electronic counters an inductance and a rectifier are placed in shunt with a resistor which is series connected between the source of anode voltage and the interconnection of the tube's plates, with the result that the low direct current resistance of the inductance substantially eliminates the drop in voltage due to the shaping circuit. Consequently a lower source of anode potential can be used. The inductance presents a high impedance to the square wave pulses, and so does not affect the operation of the circuit in respect to the pulses. The rectifier is connected to eliminate the pulses corresponding to one of the edges of the input square wave pulse. (auth)

9554

ELECTRONIC COUNTER. N. F. Moody (to U. S. Atomic Energy Commission). U. S. Patent 2,698,383. Dec. 28, 1954.

An electronic counter is described which is designed for automatic counting of rapidly occurring pulses. The output circuit of one binary pair provides a large, steep-front surge current to insure reliable triggering of the second binary pair. The output of the binary switching circuit is taken from the cathode of one of the binary counter tubes, the output circuit comprising a transformer and a rectifier connected across the primary of the transformer to prevent back emf when the tube current is turned off. (auth)

9555

ISOTOPE EXCHANGE PROCESS. R. W. Woodard (to U. S. Atomic Energy Commission). U. S. Patent 2,787,587. Apr. 2, 1957.

A method is given for obtaining the isotopic concentration of U by effecting isotopic exchange between ionic uranium maintained in different valence states. Aqueous solutions of uranous and uranyl ion in the form of strong mineral acid salts are maintained at a pH of approximately 2.0. The heavier isotope concentrates in the lower valent state and the lighter isotope in the higher valent state. The single stage enrichment factor is sufficiently great to make feasible isolation of a single isotope by a multistage operation. (auth)

9556

METHOD AND MEANS OF PRODUCING STEAM IN NEUTRONIC REACTORS. H. E. Metcalf (to U. S. Atomic Energy Commission). U. S. Patent 2,787,593. Apr. 2, 1957.

A power reactor is described which is capable of producing superheated steam. The reactor has a high reactivity factor producing excessive neutrons that are absorbed by thermally insulated control rods, which, in this process are heated well above the allowable limits of the fuel elements. The moderator coolant which may be light or heavy water is circulated about the fuel elements under a relatively low pressure so that it will flash to steam when a sufficient temperature is reached. The steam is then piped through the control rods thereby absorbing heat to produce the desired degree of superheat. (auth)

9557

ELECTROMAGNET REGULATOR. K. G. Macleish (to U. S. Atomic Energy Commission). U. S. Patent 2,787,737. Apr. 2, 1957.

The design is given for an improved regulator for an electromagnet to maintain constant the current through the electromagnet. The electromagnet is energized by means of a generator in combination with a resistor in series with the magnet winding. An alternating current control signal is derived by comparing the voltage across the resistor with a reference voltage and applying the differential signal to a converter. To compensate for rapid magnet field fluctuations and oscillations of said regulator, a voltage is obtained from an additional winding on the electromagnet and is electrically connected to the comparison network in bucking relationship to the voltage differential across the resistor. (auth)

9558

MEANS FOR INVESTIGATING GASES. H. H. Sander (to U. S. Atomic Energy Commission). U. S. Patent 2,788,656. Apr. 16, 1957.

A means of measuring the change of temperature of a gas by the change of frequency or pitch of a sound generated by and traveling through the subject gas is given. The gas is drawn through a hollow metal container, passing the open end of a resonant cavity on the inlet end from which sound is generated. A microphone in the container picks up the sound, and by means including a frequency discriminator any change of pitch is determined and recorded or interpreted electrically. (auth)

9559

METHOD AND APPARATUS FOR NUCLEAR PARTICLE ACCELERATION. C. A. Tobias (to U. S. Atomic Energy Commission). U. S. Patent 2,789,221. Apr. 16, 1957.

A method is given for extending the utility of nuclear particle accelerators by increasing the variety of ions that may be accelerated. Specifically, the method utilizes a conventional ion source, external to the cyclotron, adapted to produce relatively heavy ions having low multiplicity of charge. The ions are preaccelerated in a linear accelerator to a high velocity, then injected into the cyclotron in a direction where they will pass through a thin metallic foil in the center of the cyclotron, and then accelerated by the cyclotron in a conventional manner. By passing the ions through the foil, they are stripped of their remaining orbital electrons and enter the cyclotron field with a charge equal to their atomic number. (auth)

9560

FREQUENCY MODULATION SYSTEM. M. D. Martin, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,789,222. Apr. 16, 1957.

Apparatus for varying the frequency of the radio-frequency system of a cyclotron in a periodic manner is described. The present invention comprises, in general, a radio-frequency transmission line system having a vibrating blade capacitor connected between two sections thereof. When the transmission line system is suitably excited, the series capacitance is altered cyclically by the vibrating capacitor to vary the resonant frequency of the system. (auth)

9561

ION PRODUCING MECHANISM. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,789,229. Apr. 16, 1957.

An ion producing mechanism and, in particular, the method of control of the temperature of the producing means are described. The invention resides in the broad concept of maintaining the temperature of the ionization chamber at a point which is optimum to the stabilization of the ionization. (auth)

9562

SAMPLE HOLDER. W. J. Stinson (to U. S. Atomic Energy Commission). U. S. Patent 2,789,688. Apr. 23, 1957.

A device is described for mounting samples for use in a fission counter. The device consists of a combination of a mounting for the sample with a jig for use in the fission counter. A disc of the sample to be tested is placed in a mounting ring so that it is held by a lip on the exposed face and locked in place by a snap ring inserted from the back side. A hole in the snap ring fits over a peg on the jig. Levers are arranged to remove the mounting ring from the jig and also to disengage the snap ring so the sample disc may be lifted out. This device permits the accurate placement of the sample, and manipulation with a minimum of handling and exposure by the operator. (auth)

9563

RADIATION DETECTING AND MEASURING SYSTEM. H. G. Beyer, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,790,086. Apr. 23, 1957.

A device is described for detecting and counting the number of fissions occurring within a sample substance. This information may be used in isotopic analysis to determine the proportion of the fissionable isotope existing in the sample substance. The sample substance is placed in several chambers that are adjacent to a source of neutrons of known flux density. The apparatus is well shielded to exclude the incidence of random neutrons from external sources. Accompanying ionization chambers are provided that contain a petroleum substance for slowing or moderating the fissioned radiation to a thermal range, an ionizable gas, and electrodes carrying a high potential. The moderated radiation ionizes the gas which permits a current to flow between the electrodes, then this current is amplified and recorded to indicate the rate of occurred fissioning within the sample substance. (auth)

9564

NEUTRONIC REACTOR. R. W. Powell (to U. S. Atomic Energy Commission). U. S. Patent 2,790,760. Apr. 30, 1957.

A reactor design and appropriate cooling system are described whereby the pile is split into two equal portions with a small gap between them. The cooling fluid, which in this case is air, is introduced through ducts adjacent to the gap into the center of the pile from whence it flows outward through cooling ducts of expanding area to the faces of the pile. This type of cooling flow is principally advantageous for the use of air as the cooling medium; however, by splitting the pile, neutron losses tend to be large. The core design of this reactor reduces these losses to a reasonable amount. (auth)

9565

NEUTRONIC REACTOR. L. A. Ohlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,790,761. Apr. 30, 1957.

A method of controlling a neutronic reactor by controlling the rate neutrons may leak from the pile is described. One or more reflectors are rotated about the pile,

and each reflector has an opening in it. When the openings coincide neutrons may leak out, and the length of time the openings are in coincidence depends on the relative speed of rotation; therefore, the reactor is thereby controlled by the relative speed of the rotating reflectors. (auth)

9566

ION ACCELERATOR BEAM EXTRACTOR. B. T. Wright (to U. S. Atomic Energy Commission). U. S. Patent 2,790,902. Apr. 30, 1957.

An improved means for extracting a charged particle beam from a high energy accelerator is given. The beam extractor comprises a target and a suitably disposed deflecting magnet, whereby the ion orbit is caused to expand, impinging the ions on the target, causing the ions to lose energy with a consequent radially inward movement of the ions into the influence of the deflecting magnet; the deflecting magnet being adapted to deflect the ions through an exit aperture. (auth)

9567

IONIZATION CHAMBER FOR FISSION COUNTING. M. J. Bartkus, H. A. Kermicle, and J. H. Lykins (to U. S. Atomic Energy Commission). U. S. Patent 2,790,919. Apr. 30, 1957.

Improvements for ionization chambers that minimize maintenance and reduce fission counting dead time are given. Nitrogen replaces air which speeds up the electron collecting time. The spacing between the electrode has been reduced, thereby lowering the alpha background pulse; and one electrode has been reduced in size, permitting, by reason of lowered capacitance, a greater signal output per unit charge. Reflection of the neutron flux is enhanced by the use of paraffin as the reflector material. Other changes are incorporated as efficiency and maintenance improvements. (auth)

9568

ELECTROSTATIC MEMORY SYSTEM. R. W. Schumann (to U. S. Atomic Energy Commission). U. S. Patent 2,790,931. Apr. 30, 1957.

An improved electrostatic memory system for storing and reproducing information from cathode ray tubes is described. The manner in which information is stored at a discrete area on the tube face consists of deflecting the beam and turning it on at the normal spot, turning the beam off and twitching it to the left or right and turning on the beam on again to represent either the binary 1 or 0, respectively. To extract information from the memory both the normal and rewrite spots are inspected in turn. Appropriate circuitry determines which binary has been stored by means of the distinctive signals created by each when inspected. (auth)

9569

THERMIONIC IONIZATION VACUUM GAUGE. O. H. Ottinger, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,790,949. Apr. 30, 1957.

A structural arrangement of electrodes for a thermionic ionization vacuum gage is described. Three insulated electrodes are disposed concentrically; the intermediate electrode is a thermionic filament, the outer electrode is a helical coil, and the inner electrode is a straight single member. A substantial positive potential is applied to the outer electrode, while the inner electrode is maintained at a negative potential, so that gas particles ionized by the electrons from the filament will be attracted to the inner electrode with the resultant current flow in the associated circuit being a measure of the gas pressure. (auth)

9570

LIQUID LEVEL INDICATOR. W. H. Zinn and J. M. Harrer (to U. S. Atomic Energy Commission). U. S. Patent 2,791,119. May 7, 1957.

A remote liquid level indicator is described which is designed to accurately indicate the liquid level in a container which may be normally inaccessible, therefore simple dependable equipment in the tank is a necessity. Using a bubble gage in the container, an inert gas is forced to the bottom of the tank, the flow of gas being dependent on height of the liquid above gas orifice and the pressure of the gas. If the pressure is measured by a manometer with legs of unequal diameter, the gas pressure is transmitted to the thinner leg, and the force is multiplied in the thicker leg to act on an electrical transducer that gives an electrical indication to be read on a suitable meter. (auth)

9571

RADIO FREQUENCY ION PUMP. J. S. Foster, Jr., et al (to U. S. Atomic Energy Commission). U. S. Patent 2,791,371. May 7, 1957.

A radio-frequency ion pump capable of relatively continuous highly efficient operation is described. The apparatus comprises an evacuated envelope with input and output regions, and a radio frequency generator with associated electrodes circumscribing the chamber creating an oscillatory electron current within the envelope. When a gas is injected into the chamber, the gas molecules are ionized and an arc is produced with the gaseous discharge being collimated along the center of the chamber by the action of a constant magnetic field. The ions are then removed from the chamber by suitable means. (auth)

9572

TIMING CIRCUIT. W. C. Struven (to U. S. Atomic Energy Commission). U. S. Patent 2,792,535. May 14, 1957.

An improved electrical timing circuit is described which is adapted to produce a timed sequence of events in response to a trigger signal and including means precisely controlling the operating time or duration. The significant feature of the disclosed circuit is that the timing period is controlled with a high degree of accuracy both for short and long periods. (auth)

9573

TOLERANCE INSPECTION GAGE. F. Kerze, Jr., and J. T. Howe (to U. S. Atomic Energy Commission). U. S. Patent 2,792,634. May 21, 1957.

A tolerance gage for determining the permitted spacing between two parallel plates is described. Two cams, representing the maximum and minimum permissible distances are mounted on concentric shafts which are in turn attached to knobs. The cams are placed between the plates to be measured and the knobs rotate in such manner that the knob attached to the cam of maximum diameter does not rotate completely, whereas the knob on the minimum distance cam rotates completely. (auth)

9574

NEUTRON PROPORTIONAL COUNTER. J. A. Simpson, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,793,309. May 21, 1957.

A slow neutron proportional counter is described for measuring neutron density in a slow or medium neutron field as may occur in a conventional reactor. A casing of lucite contains two Al plates which have boron coated areas thereon, and a number of wires spaced about the plates at a high electrical potential. Methane gas flows through the casing. Incident neutrons are slowed by passage through the lucite casing, some of which impinge on the Al plates and are absorbed by the boron coating converting it to Li and releasing alpha particles. The alpha particles ionize the CH_4 and current may flow from the wires to the plates in proportion to the density of the neutron field. This counter permits measurement of weak neutron fields, and is light and portable, thereby facilitating its use. (auth)